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BRUCE'S SCHOOL SHOP ANNUAL

The March issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, this year, was chosen to bring the Bruce's School Shop Annual to its readers. The content of this special number was chosen with special care in order that the objectives of the shop annual might be achieved.

For this reason, the subject of *The School Shop* is presented by four articles and *What Others Are Doing*, by five. There are six articles on *Courses and Instruction Sheets*, five on *Shop Management*, three on *Supervision*, and one each on *Safety* and *Guidance*.

Most of these articles are written by well-known leaders and experts in the field of industrial arts and vocational education. All of them contain valuable material for the superintendent of schools, for the supervisors and directors of industrial arts and vocational education, for the teacher trainer whose responsibility it is to prepare the shop teacher, and lastly for the shop instructor who wants to understand and carry out the duties of his profession in the very fullest measure.

Besides the helpful articles indicated in the foregoing, this Annual, as did its predecessors, contains maximum lists of equipment, supplies, and materials which will prove valuable to anyone confronted with the job of equipping a school shop.

It is the editor's hope that this Annual will assist in advancing the cause of industrial arts and vocational education.

PROBLEMS, PROJECTS, SUPPLEMENT, AND POSTERS

With the large amount of professional material which has been put into this issue, the problems-and-projects section, the supplement, and the posters had to be excluded. These omissions, deplorable as they may be, were unavoidable and their absence in this issue will be amply counterbalanced by the offerings in coming issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

RESERVE THESE DATES

Illinois Industrial Education Association, Automobile Mechanics Contest, Peoria, Ill., March 26, 27, 1937.
Eastern Pennsylvania Industrial Arts Conference, State Teachers College, Millersville, Pa., Saturday, April 10, 1937.
Western Arts Association Convention, Toledo, Ohio, April 14–17, 1937.
Conference of Drafting Teachers, Iowa State College, Ames, Iowa, April 23, 24, 1937.
Industrial Arts Conference, State Teachers College, California, Pa., April 16, 17, 1937.

Articles Indexed — The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature." and "Education Index."
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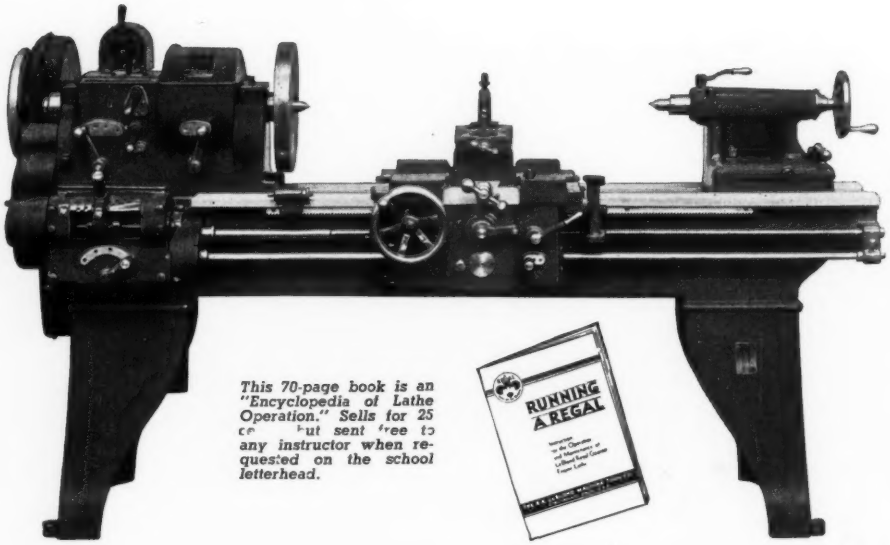

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The Industrial-Arts Laboratory

Louis V. Newkirk
Director of Handwork,

Colman Hewitt
R. T. Hunter
Research Staff, Board of Education, Chicago, Illinois

The charts presented give an excellent picture of this new course which has just been introduced in the Chicago school system.

The industrial-arts laboratory is a new course for the Chicago schools designed to interpret the modern industrial and trade world to ninth-grade boys in the academic high schools. The course is being developed under the guidance of Dr. William H. Johnson, superintendent of schools, and Mr. George F. Cassell, assistant superintendent in charge of high schools. The industrial laboratory is to the study of the industries and building trades what general science is to the study of the sciences. It gives the boy a picture of a large section of the world's work and

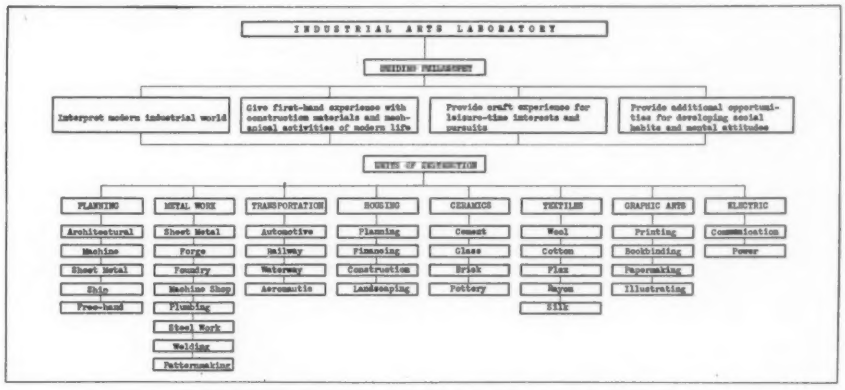

Chart I. An analysis of what the industrial-arts laboratory offers

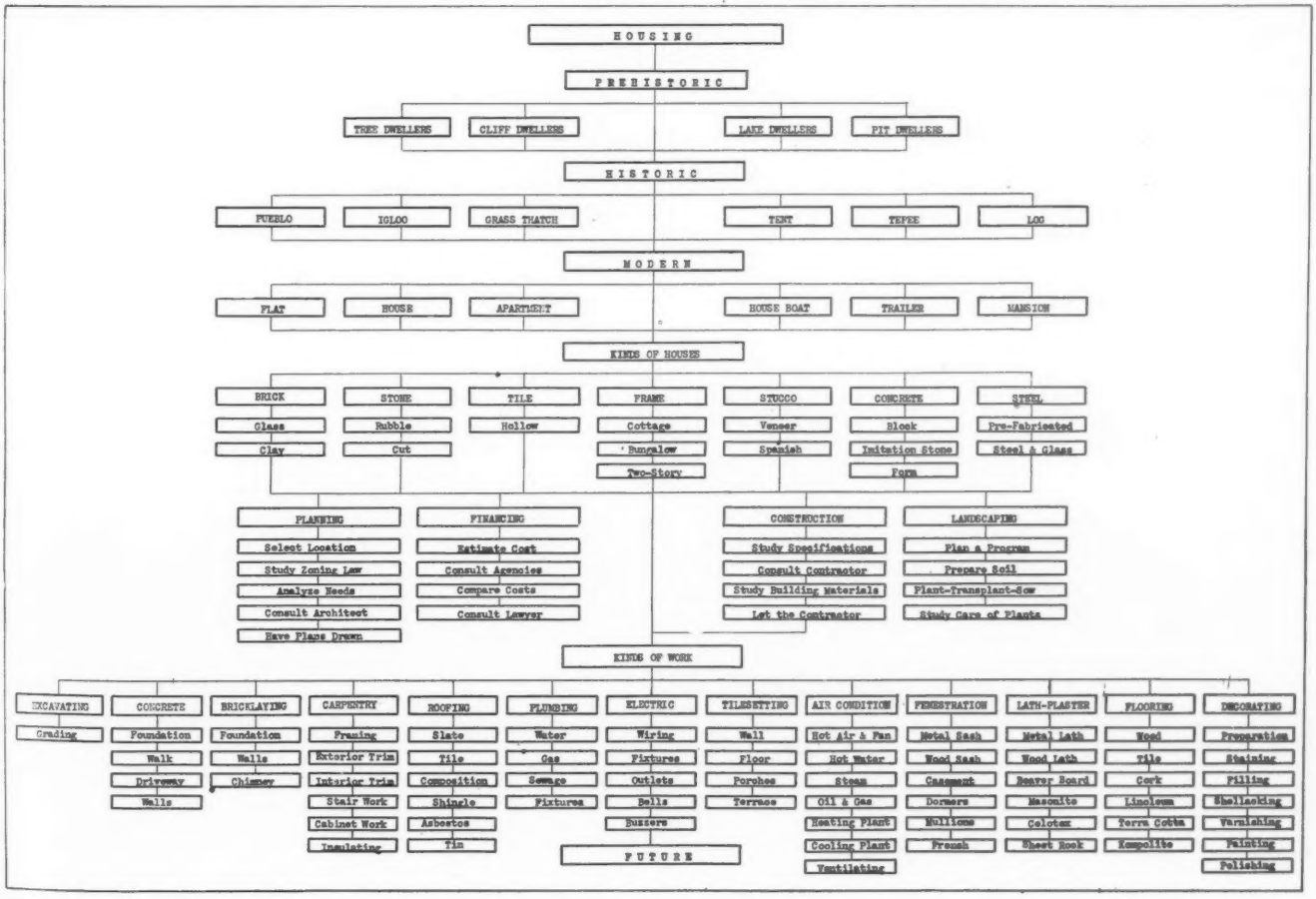

Chart V. An analysis of housing

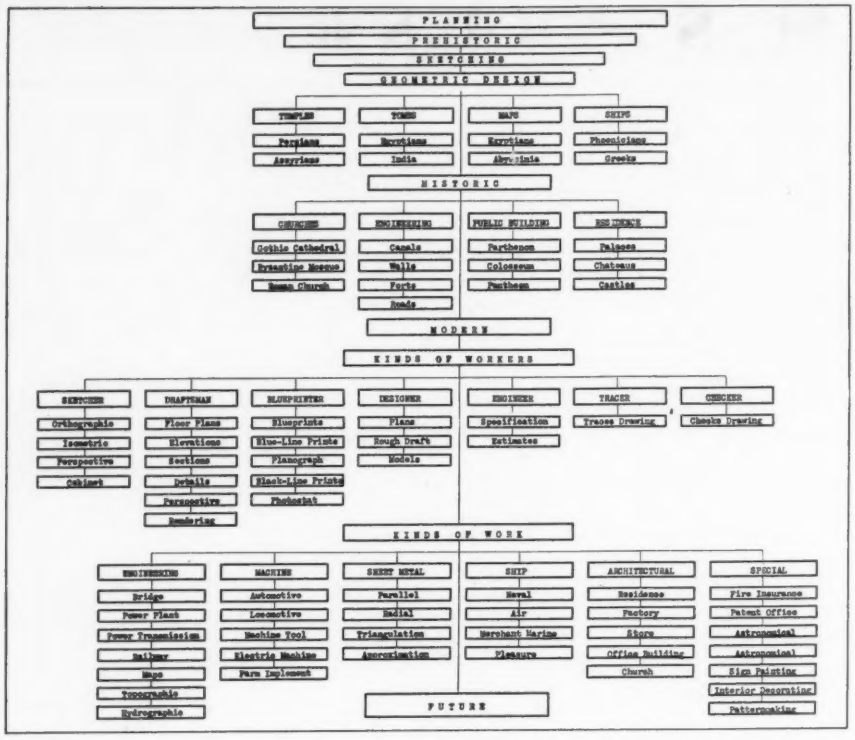

Chart II. An analysis of the planning unit

acquaints him with a variety of tools and materials. The tool skills and related information taught in the industrial-arts laboratory are valuable for general education and may serve as a foundation for future vocational training for industry and the trades.

The industrial-arts laboratory is a *doing* course, alive with instructional material related to the educational and vocational problems confronting youth of the teen age. It is a practical course with ample time allotment for construction and supervised planning. The course meets for a double period five times a week for two semesters. About 80 per cent of the instruction time is devoted to manipulative learning with a variety of hand tools, machines, and a variety of construction materials. The industrial-arts laboratory gives a high education return for the money expended as it does not require expensive machines or large quantities of expensive materials.

Although approximately 80 per cent of the instructional time is devoted to manipulative learning, opportunity is given and facilities provided for trips to industry, moving pictures, and related reading. Each instructional unit is to have a well-selected reference library for student use.

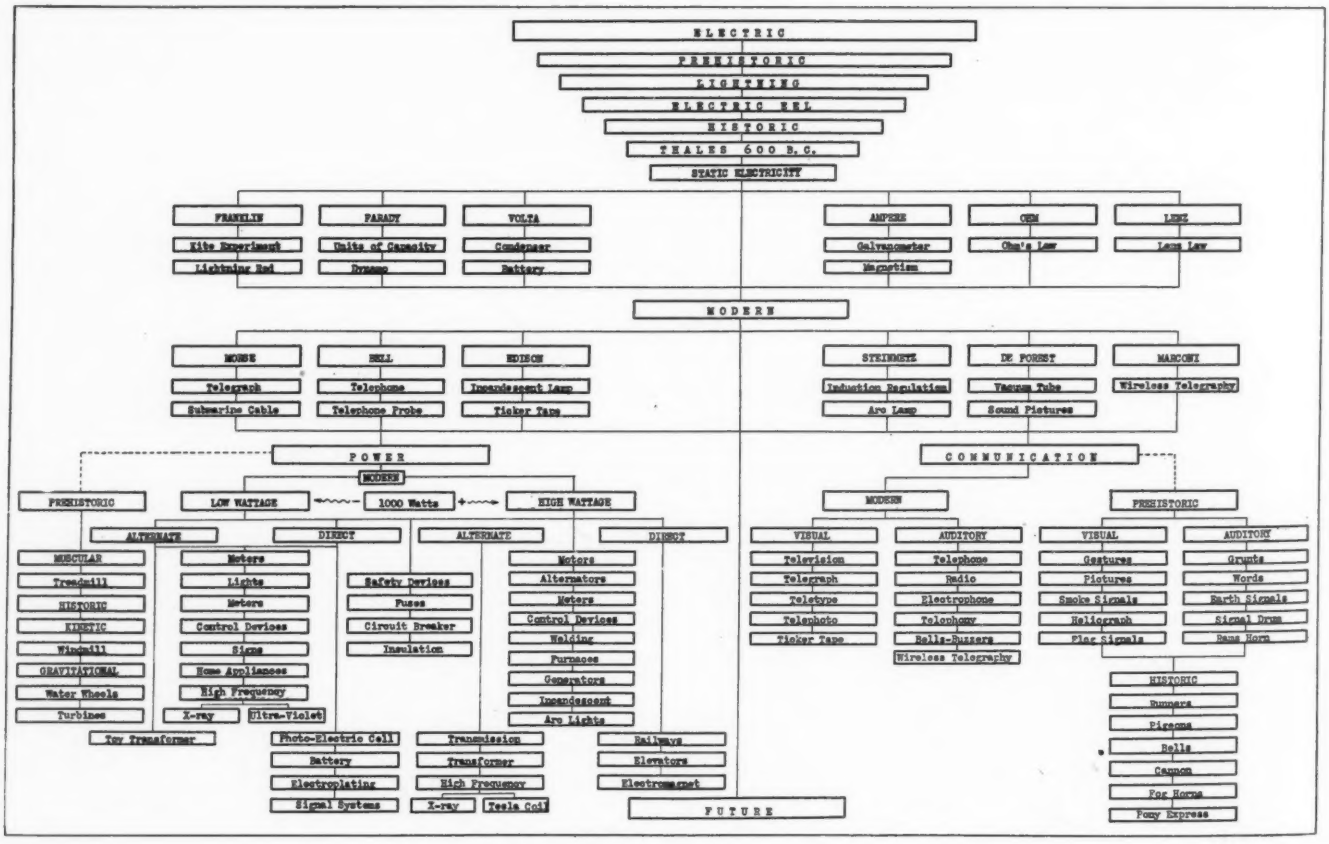

Chart IX. An analysis of electricity

Five industrial-arts laboratories are in operation and they will be further refined and developed during the coming semester. These experimental industrial-arts laboratories are located in the following high schools: Sabin branch of Tuley, Wells, Manley, Morgan Park, and Westcott

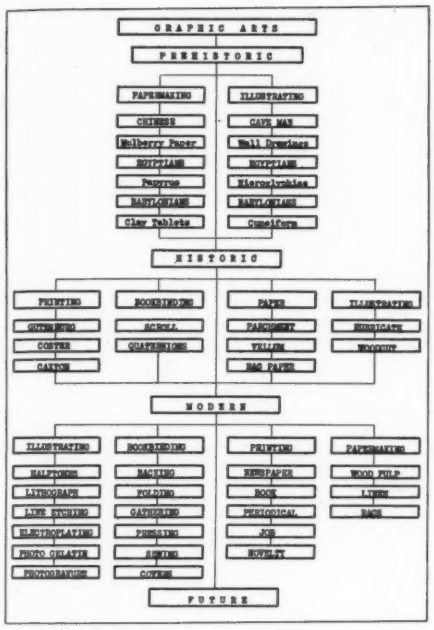

Chart VIII. An analysis of graphic arts

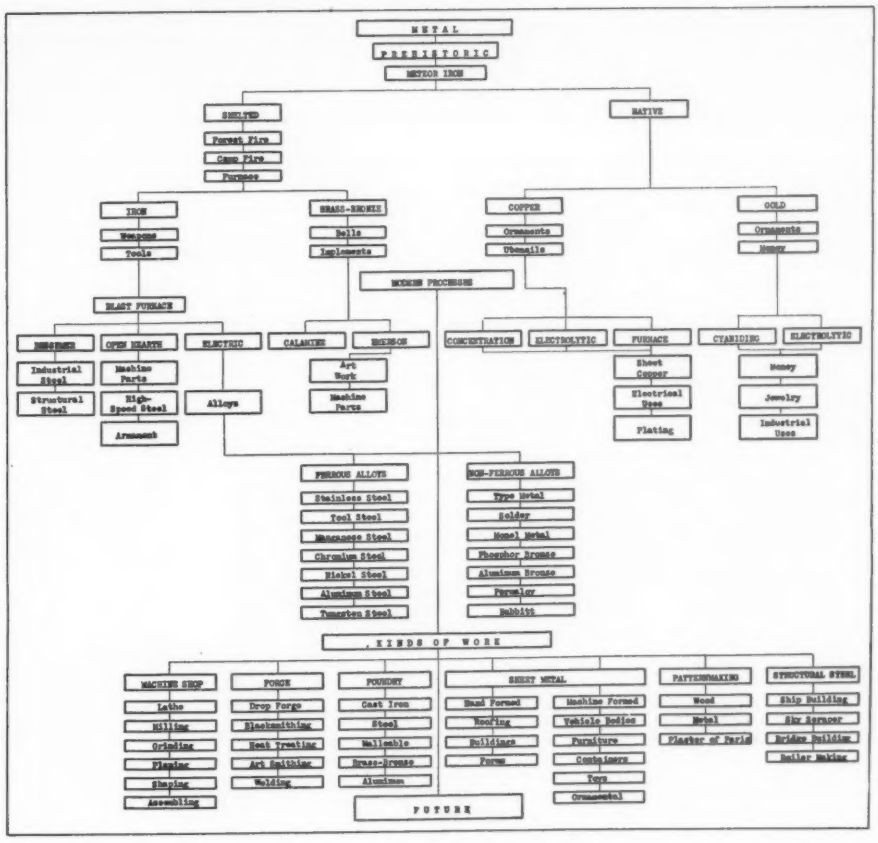

Chart III. An analysis of metalwork

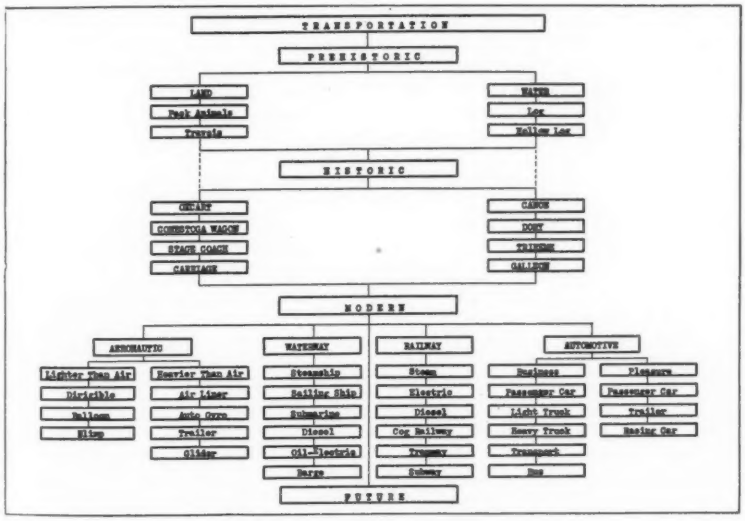

Chart IV. An analysis of transportation

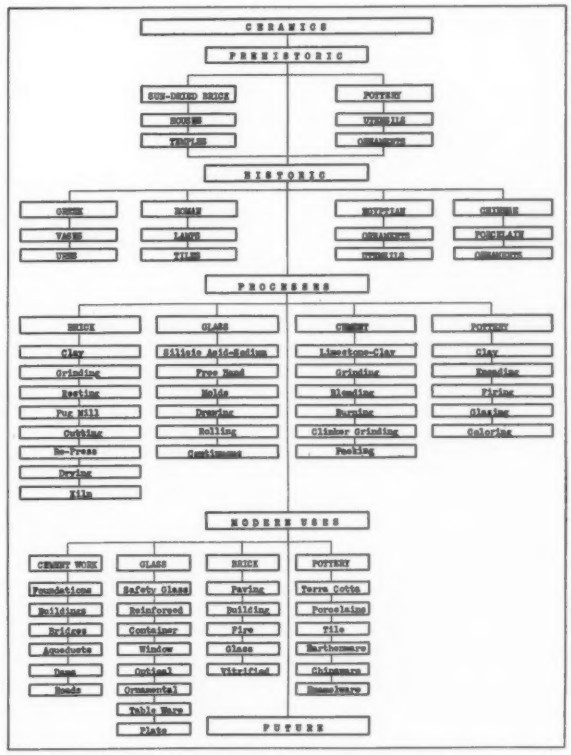

Chart VI. An analysis of ceramics

branch of Calumet. The industrial-arts-laboratory course is not necessarily limited to one room, but the number of rooms and instructors used depends on the facilities and teaching staff afforded by the particular school.

The graphic analysis, Chart I, gives the guiding philosophy and outlines the 8 instructional units used. Charts II to IX inclusive are detailed analyses of the various instructional areas. These graphic charts are used as a part of the instructional materials of the course and help give the boys a picture

of the area of work and the relationship of their job to the whole industrial or trade area. In addition to this graphic analysis, instruction sheets are in preparation in the bureau of curriculum research for each of the eight instructional areas. The development of the instructional materials is used under the supervision of the authors of this article and Miss Mary C. Lusson, assistant secretary, board of curriculum. Special credit is also due the principals and teachers of the clinic schools for their many valuable suggestions and co-operation in developing the course.

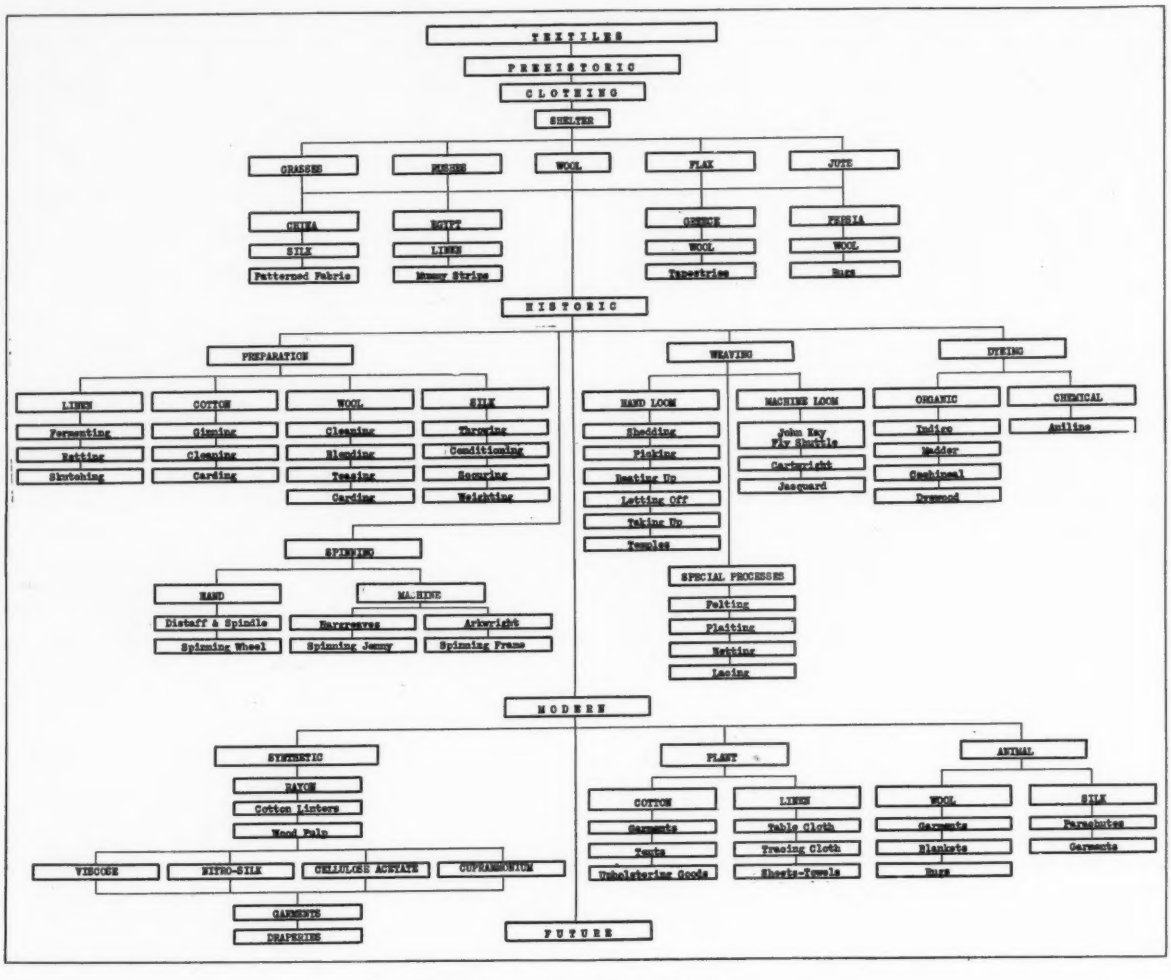

Chart VII. An analysis of textiles

Industrial Arts in Smaller High Schools

John R. Ludington

Professor Industrial-Arts Education,
Ball State Teachers' College,
Muncie, Indiana

Since the primary concern of the school is to assist the child to adjust itself to the demands of modern life, college-preparatory courses, for the majority of students in urban and rural high schools, are no longer tenable. (*Author's address before the Ohio Industrial Arts Conference held March 14, 1935, in Columbus, Ohio.*)

During recent years the small high school has become the focal point of considerable discussion. There seems to be developing an accrescent consciousness of the inadequacy and inefficiency of the small school, and a pronounced feeling that it is not capable of meeting present-day educational needs of pupils because of its restrictive curriculum offerings. This trend is quite noticeable as one carefully examines the recent publications on secondary education in practically all of the states.

In some respects our theories of secondary education are far in advance of present practice. It has been said by some writers in this field that "one of the reasons for the failure of leaders in education to articulate more closely theory and practice in secondary education is the persistency of the small school."

Before discussing the problem further, the writer wishes to say that any comments or criticisms that may be made are

presented from the point of view of the general situation as a whole rather than at any particular school, administrator, or teacher.

From year to year, a larger and larger percentage of the total population of school age is being enrolled in high school, this is due largely to the fact that the American people have come to realize that a high-school education is none too much to meet present-day social-economic standards of living, and to the fact that the modern high school is attempting to meet the needs of the pupils and of society better than it did years ago.

It is of interest to measure this increase. The proportion of pupils enrolled in high school in 1880 was only 1.1 per cent of the total school enrollment according to the United States Office of Education Biennial Survey of Education.[1] There has been a gradual increase from that time to 19.6 per cent in 1932.

This great increase in the enrollment of adolescent boys and girls of high-school age in the secondary schools of the nation, is itself indicative of the intense interest of youth in educational programs, and of some respect on their part of the value and the relation of education to modern life. In countless cases, however, these ambitious desires are doomed to rather harsh disappointment because of the inhibitive nature of the programs found in thousands of high schools throughout the country to meet the needs of the student.

What is a "small" high school? What is the status of these schools in the nation or in a particular state? What can *we* do for the small secondary school? According to F. W. Cyr,[2] "One of the most serious and perplexing problems in American education is that of providing an adequate educational program in the small secondary school."

Just how small is a "small" high school? Until the present time very few studies have dealt with this specific problem. According to Soper[3]: "Those who have written on the problems of the small high school have had various sizes in mind. . . . No generally accepted size group defines the small high school in the thinking of those who have given it consideration and study. There is also the possibility that the size might vary in different sections of the country, dependent upon density or sparsity of population."

A recent study of the small high school in the state of New York[4] led to the surprising conclusion that "the minimum size high school which could offer a satisfactory program was one of between 200 and 250 enrollment." This conclusion, of course, rests upon the assumption that the present type of high-school program, in which new interests and new needs are provided for by the addition of new courses rather than by a fundamental reorganization of the high-school program, are to be continued.

Monograph No. 6 of the National Survey of Secondary Education[5] which deals with *The Smaller Secondary Schools* reaches the conclusion that "size is a more important factor than selection in making for constructive differences among small high schools."

Since nearly all of the small high schools are in rural areas and since nearly all rural communities having high schools have small ones, the literature on the small high school and that on the rural high school is practically synonymous.

When a community ceases to be rural and to take on urban characteristics is a question not easily answered. For statistical purposes, however, incorporated places having a population of 2,500 or more are classed by the Bureau of the Census and the Office of Education as urban, and the remainder of the country as rural.[6]

Although no agreement has been reached on what size school constitutes a small high school, Soper[7] says that; "those schools with fewer than 100 pupils enrolled are the ones commonly thought of a small high schools." *The average size of the small rural high schools for the nation is approximately 75 pupils.* According to the last biennial report of the United States Office of Education for 1930, 54 per cent of the public high schools of the United States have an enrollment of fewer than 100 pupils.

The United States census figures for 1930 show that approximately 56 per cent of the total population was urban and 44 per cent was rural, and that only .3 per cent more children, 5 to 17 years of age, lived in cities than in rural areas at that time. *More than half of the total number of rural schools are of the one-room type.*

The *Indiana School Directory* for 1934–35 records 42 per cent of the total number of schools in Indiana as being of one-room type.

The *Biennial Survey of Education 1930–32* shows that the average number of pupils to a teaching position in the cities is 1.6 and in the rural communities the average is 27.5. In the cities, the average number of pupils to a building is 485, while in the rural area, the average to a building is only 59.

The estimated value of city school property is more than twice as great as that of rural school property. In twelve states, rural school property is valued at less than $100 per pupil. Cost or expenditure based on the average number of pupils in average daily attendance in city schools was $108.93, and in the small rural schools $64.39.

When the situation is examined with respect to the number of subject preparations per teacher, it is found that the average number of daily preparations in different subjects is four and one-half per teacher in the smaller schools. As schools become larger in enrollment, this number decreases.

What is the status of the problem from the standpoint of industrial arts?

According to figures furnished by Dr. William E. Warner, of the Ohio State University, nearly 1,000 of the 1,400 high schools in Ohio are of the one-teacher shop type. The situation is somewhat similar in Indiana. Recent figures show that 53.3 per cent of the industrial-arts teachers in Indiana teach in one-teacher shops, with nearly all of these men teaching from one to four other subjects in addition to their major subject. Physical education, mathematics, social studies, and science, head the list of combinations with industrial arts in the order named.

In New York[8] "Schools below 200 enrollment are seriously handicapped in their ability to offer a program of studies sufficiently enriched to meet modern educational needs." According to statistics in Bulletin No. 1071 of the University of the State of New York[9]: "Industrial arts does not command any importance in the curricula of the high schools until enrollments of from 300 to 350 are reached. Only woodworking commands any importance at all in the smaller schools and then only in 10 per cent and less of the schools." This situation is even more acute in other states.

So much for the statistical nature of the problem. What are some of the major issues which confront educators in these small schools, and which prevent them from meeting an ever increasingly complex social and economic need?

It has been found as a result of the analysis of the figures quoted in the foregoing, that throughout the country as a whole the small high school works under very definite handicaps with regard to a limited curriculum, small pupil-teacher ratio, and meager financial income.

This state of affairs is causing many of the leading educators of the country to say that, "the small high school which served

[1] See page 6 in reference No. 17 at end of article.
[2] See page 121 in reference No. 6 at end of article.
[3] See page 40 in reference No. 16.
[4] See page 3 in reference No. 16.
[5] See reference No. 18.
[6] See page 35 in reference No. 17.
[7] See page 10 in reference No. 16.
[8] See page 7 in reference No. 16.
[9] See page 58 in reference No. 16.

many communities a generation or more ago, is totally inadequate today."

In spite of the fact that comparative figures show that the proportion of small high schools is slowly decreasing because of increased enrollments, the problems of these small schools are becoming even more serious. The very fact that increasing numbers are attending all of our secondary schools means that the older, formal college-preparatory type of school is becoming increasingly less able to meet the needs of those attending. It is difficult, if not impossible, in the very small schools to meet both the requirements for college entrance and the needs of the pupils. There is, however, leadership in the direction of encouraging the small school to introduce courses more closely related to the needs of the pupils.

In this connection it will be of interest to those in the small high schools to study trends in college-entrance requirements and the work of The Eight-Year Study of the Commission of the Progressive Education Association on the Relation of Secondary Schools and Colleges.

In general the majority of the weaknesses of the small high school are reflected in the curriculum offerings and organization. The best summary of the problems of the small school which has been made to date is the one reported in the *Sixth Yearbook of the Department of Superintendence of the National Education Association.*

An examination of this and other reports emphasizes the fact that in most cases the leaders of the small schools are confronted with the problem of deciding whether or not the curriculum offerings should center around the social-economic conditions in the small communities or rural areas alone, or should they be concerned with all problems and activities involved in realizing the maximal individual child growth and self-expression and in promoting greater social well being and progress through the oncoming generation regardless of station in life.

Are the basic educational needs of boys and girls who live in the smaller communities different from those who happen to live in urban centers?

In answer to this question Professor Brim of the Ohio State University[10] says:

There are few, if any, characteristics of rural life and education that cannot be found in some small degree in non-rural life. Most, if not all, differences are differences in degree rather than kind. The major differences between rural and urban people are due to nurture rather than to nature. The general objectives of rural education do not differ from the objectives of urban education on the same level. The responsibilities of the school are to the child and to society as a whole, not to the local group whose children it is educating.

The specific objectives, however, the means by which the larger objectives are attained, will, since they are determined by the resources, experiences, and needs of children in smaller communities, be peculiar in part to rural life.

This same idea is expressed in other words as follows:[11]

The ultimate objectives and fundamental purposes of secondary education should be the same whether the school which houses the pupils is located in the city or in the country. . . . Broadly speaking, while the ultimate objectives may be the same, the means of arriving at them will vary with conditions peculiar to rural and to city life.

The educational system must be evaluated in the extent to which it succeeds in developing persons individually and socially efficient with regard to the maturity and capacities of its pupils.

The primary concern of the school is to provide material and equipment which will help each child to adjust himself effectively to the practical and cultural demands of modern life. This does not mean for most pupils in the smaller schools a college-preparatory course.

[10]See page 258–59 in reference No. 10.
[11]See page 13 in reference No. 16.

The fundamental purpose of all high-school education is liberal and general in its nature. College preparation should be a secondary function, or at most only one of the several functions of any high school.

All of this implies that the small high school must include a program which is vitally concerned with the type of society in which we now find ourselves. This means a highly developed industrial type of civilization. If industrial arts is adequately to care for this need, the philosophy upon which its program is based must find root (1) in the nature of the individual, and (2) in the social-economic forces of present-day civilization and in the material and cultural heritages of the past. The first determines *method* or the basic psychology which would underlie such a program, and the second determines the *content* of subject-matter areas.

These antecedents determine the nature of the industrial-arts program on all maturity levels from the first grade up to and including adult life, with emphasis upon such major objectives as the realization of an *attitude of social responsibility* and *co-operative living through effective thinking*. These are accomplished in an industrial-arts *Laboratory of Industries* in the planning and solving of problems of life dealing with persons, materials, tools, machines, and basic industrial processes.

One of the best methods of aiding the small high school in the attainment of these objectives is through the establishment of county committees and the creation of "developmental centers." Several such experimental centers are now in operation in Ohio. An outstanding example of this co-operative action is found in Franklin County, Ohio, under the direction of the Franklin County Committee on Industrial Arts.

The success of such a program depends upon the co-operative experimental method of attacking problems. The industrial-arts teacher cannot be expected to promote the program of the small school by adopting bodily the program of a large urban center. Strong local leadership is important to an adequate educational program in the small school. A scientific approach to the study of the problems of the small school is necessary. Definite and workable plans of county and state organizations are needed for continuous co-operative action in solving problems.

Selected Bibliography

1. Brim, O. G., *Guiding Principles in Rural Education,* Thirtieth Yearbook, Part I. National Society for the Study of Education, Bloomington, Ill., Public School Publishing Co., 1931, p. 262.

2. Bristow, W. H., "Some Major Curriculum Problems in the Rural Secondary School," *National Education Association, Proceedings,* 1933, pp. 450–453.

3. Clifton, John L., *The Small Secondary School in Ohio,* Columbus, R. G. Adams Co., 1929, p. 159.

4. Coxe, W. W., "Educational Needs of Pupils in Small High Schools in New York State," *Sixth Yearbook, Department of Superintendence,* 1928, p. 104.

5. Coxe, W. W., and Cowen, P. A., *Educational Needs of Pupils in Small High Schools,* University of the State of New York, Bulletin 969, April 1, 1931, p. 63.

6. Cyr, Frank, "What Can Be Done for the Small Secondary School?" *Bulletin of the Department of Secondary School Principals,* Vol. 50, pp. 121–27, March, 1934.

7. Ferriss, E. N., *Secondary Education in Country and Village,* New York, D. Appleton Co., 1927.

8. Ferriss, E. N., "Some Important Curricular Problems in Rural Secondary Education," *Thirtieth Yearbook, Part I. National Society for the Study of Education,* Bloomington, Ill., Public School Publishing Co., 1931, p. 51.

9. Ferriss, E. N., "Charting the Future of Secondary Education in Rural Communities of the United States," *National Education Association Proceedings,* 1932, p. 490.

10. Ferriss, E. N., "Curriculum Characteristics and Trends in Rural Secondary Schools," *National Education Association Proceedings,* 1933, pp. 448–50.

11. Gaumnitz, W. H., *Economies Through the Elimination of Very Small*

Schools, U. S. Office of Education, Bulletin 1934, No. 3, Washington, Government Printing Office, 1934.

12. Gaumnitz, W. H., *The Smallness of America's Rural High Schools*, U. S. Office of Education, Bulletin 1930, No. 13, Washington, Government Printing Office.

13. National Education Association. Department of Rural Education, *Economical Enrichment of the Small Secondary School Curriculum*, 1934.

14. National Education Association, "The Rural Problem," *Journal of the N.E.A.*, Vol. 23, May, 1934, p. 139.

15. National Society for the Study of Education, *Curriculum of the Rural Secondary School*, Thirtieth Yearbook, Part I. Bloomington, Ill., Public School Publishing Co., 1931, pp. 125–54.

16. Soper, Wayne W., *The Small High School*, University of the State of New York, Bulletin No. 1071, July 1, 1935, p. 80.

17. United States Office of Education Bulletin, 1933, No. 2. *Biennial Survey of Education 1930–32.*

18. United States Office of Education Bulletin, 1932, No. 17. Ferriss, Gaumnitz, and Brammell, *The Smaller Secondary Schools*, Monograph No. 6, National Survey of Secondary Education, Washington, Government Printing Office.

19. United States Office of Education Bulletin, 1932, No. 17. Kefauver, Noll and Drake, *Secondary School Population*. Monograph No. 4. National Survey of Secondary Education, Washington, Government Printing Office.

20. United States Office of Education Bulletin, 1932, No. 17. Spaulding, Frederick, and Koos, *Reorganization of Secondary Education*, Monograph No. 5, National Survey of Secondary Education, Washington, Government Printing Office.

Training for Industrial Adjustment

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A question which is confronting every shop teacher, and the solution has not as yet been definitely found.

For many years, the school has emphasized specific skills in training youth to meet the demands made upon him when he left the school to enter industry. In so doing, he was given a salable asset which enabled him to face a prospective employer with greater confidence and to attack a familiar task with more assurance. During the past few years, however, industrial organization has rapidly changed and the demands made upon potential employees now differ widely from those of even a few years ago. Those who are interested in the training of youth have watched these changes with great interest and have attempted to keep their organizations sufficiently malleable to adjust readily to new demands made upon them.

As industry has changed, the emphasis on specific skills seems to have decreased and demands are made upon the schools to provide an employee who has some of the skills but who is also adaptable to fit into a variety of situations. Industry seems to have arrived at the point where a specialist who lacks the ability to adjust may soon be out of work, but an individual with adaptability can move about and acquire many of the required skills while on the job.

The question which faces the educator today is how he may best contribute to the training of individuals to provide them with that flexibility. It is quite apparent that the type of work now being offered in many vocational schools and industrial-arts departments makes a vital contribution to such training, but there is a danger that the school assumes that adaptability in industry is readily developed by exposing the student to a variety of experiences in the school shops. This is not true, however, since adaptability to a variety of situations depends more upon emotional stability than upon any skills which we may develop. The individual whom the school sends out into industry, therefore, must be emotionally well balanced as well as conversant with a wide range of technical operations. The school knows how it may contribute to the latter, and it is taking care of this phase of its work at the present time, but it is still faced with many questions as to its contribution to the development of emotional stability of the student. The question which must be considered is, what constitutes emotional stability in an individual and what can be done to help him to produce it, especially in those individuals who seem to be lacking in some characteristics while they are attending school.

In most modern school systems, there are rather complete records which follow the student as he progresses from grade to grade. These contain not only his scholastic standing, but also information about his intelligence quotient, his health, and his personal characteristics. These records should be used by the teacher of vocational work and industrial arts especially in the cases of problem children. It is well, however, to work for some time with the boy before referring to this information so as to form an independent opinion as to his personality and work habits. The information as to intelligence quotient, scholastic standing, and health must be accepted for what it is worth, but there may be a decided difference of opinion as to personality and work habits as different teachers observe the response of the individual to the stimuli of entirely unrelated and widely divergent situations. Having made a careful study of each case, the shop teacher is in a position to decide which cases need special help in order to develop that adaptability which seems essential to industrial success. Many of these boys have problems which are in no way related to health or intelligence quotient but are the result of antisocial attitudes built up over a period of years and, with careful study and persistent effort, a great deal may be done to help them. The instructor must first account for the difficulty, then do remedial work and after that do frequent testing to see if he has accomplished his purpose. The best way to account for the difficulty is to gain the confidence of the boy, talk with him until he provides a rather complete story of his background and analyze it for possible frustrations which would affect the right point of view. Then it becomes necessary to provide satisfactions which will compensate, at least in part, for those things which the boy has been denied. Lastly, the boy must be placed in a position, at intervals, where he is required to react to a real situation so that his reactions may be studied, and his attitudes checked.

One difficulty with this type of work is that no one is in a position to recommend a magic formula or even make any very definite recommendations as to how it should be done. This depends upon the personality of the teacher, the personality of the student with whom he is dealing, and the particular problem to be solved. The instructor who feels a strong desire to make such a contribution will find ways and means to fit the problem or problems with which he is confronted.

Apprenticeship

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As industry comes back to normal production levels, the need for skills becomes increasingly apparent. The invention, development, and production of tools and machines only stimulates more invention and more development, all of which calls for a constant increasing and broadening of skills and technical knowledge.

K. H. Condit, editor of the *American Machinist,* says that 78 per cent of the unemployed are also unskilled and, therefore, largely unemployable.

Thus, we have the paradoxical situation of thousands of men out of work on the one hand and industry calling for help on a mechanic's level on the other hand. An employment manager for a large firm recently said to me, "Our plant physicians are very careful about the physical qualifications of our prospective employees, but show me a good toolmaker and even if he is a cripple I will take him in." In the same plant automatic machines are working to partial capacity because the necessary tools are not available to work them to full capacity.

Lack of skilled help could be met by training or retraining of adults or by taking young workers as learners or apprentices. Only the latter plan will be considered here.

An apprentice is a learner taken on by a corporation or an employer with the definite purpose of mastering a trade through a series of carefully scheduled experiences to include the entire range of typical jobs in the trade. A probationary period of three months is desirable. Also, a contract is desirable. The written agreement dignifies the procedure and lends a certain amount of desirable formality to the plan.

The Selection of Apprentices

There are, of course, several ways of taking on new employees. Personnel men may simply go to the gate where an "employees wanted" sign is posted and call in such individuals as present themselves. Application blanks may be filled out and the men who appear desirable may be invited back. Many firms have been taking younger workers because someone's cousin or uncle works in the plant and recommends the individual. Almost regardless of the individual's qualifications he is given a job. A large number of workers chosen in this way, fail to make good.

Personnel managers and employers in general are now setting entrance requirements for apprenticeship at high-school graduation, and are further insisting that the prospective worker have training in mathematics, science, and shopwork. Industry has too long been satisfied to give employment to the "drop-outs" of the public schools instead of making use of the selective records and training possibilities of the secondary school and thus getting a superior product. An employer in northern Indiana recently informed me that he was working with the local vocational director who had selected twenty boys who were high in general intelligence and high in mechanical ability as prospective employees.

The employer said, "I have now adopted this plan as a policy to enable me to recruit new workers each year. I have selected 84 apprentices in this way. All are good, many are superior and 2 or 3 per cent may prove to be geniuses. I am well pleased with my group."

Eventually we will get three measures on boys who enter industry as apprentices. We will get a measure of their general intelligence, then a measure of their mechanical intelligence, and, perhaps, a measure of their personality rating.[1]

The Training of Apprentices

The length of the training has a tendency to remain at four years although it is doubtful if it should. Training schedules for apprentices are available from various sources.[2] These schedules should be further broken down by analysis. The present tendency is to follow a combination of the Selvidge[2] and Allen[3] plan, take each major unit of the schedule and break it down into typical jobs, then add a column with the heading "What he [the worker] should be able to do," and a third column headed "Additional information to make a more intelligent worker." In general the second column will give definite ideas about shop skills while the third column will give a basis for the related subject or technical information that may be offered in an organized way by the public vocational school.

The percentage of high-school graduates that go on to college is still rather small, thus a large percentage is left in the community eventually to find their way into employment. These graduates have been carefully nurtured through twelve years of common and secondary schooling. After graduation they are suddenly dropped with little follow-up. The community investment, to use a purely economic argument, is, perhaps, one thousand dollars per student over the twelve-year period. Wouldn't it be pure economy to follow this up and work out plans for the scientific placement of many of these graduates in apprenticeship programs?

The proper training of the industrial worker presents a problem which is national in scope, yet it still is ignored in many communities.

Skills are needed in industry. Many of our high-school graduates are mechanically inclined and should be placed in occupations in an organized way, i.e., through a careful study of their aptitudes, attitudes, and abilities. Their general intelligence and their mechanical performance should be important factors. These are problems of a guidance program.

A well-organized apprentice program will serve as a connecting link between the secondary school and life.

References

1. "Personality Can Be Acquired," Henry C. Link, December, 1936, p. 1, *Readers' Digest,* Pleasantville, N. Y.

2. *How to Teach a Trade,* Robert W. Selvidge, Manual Arts Press, Peoria, Ill.

3. *The Instructor, the Man and the Job,* Charles R. Allen, J. B. Lippincott Company, Philadelphia, Pa.

Other References:

"Modern Apprentice Training," A Compilation of Articles from *American Machinist,* McGraw-Hill Book Company, New York City.

Apprenticeship: Principles, Relationships and Procedures, Scrimshaw, McGraw-Hill Book Company, New York City.

The Old and the New

By all means let us study the masterpieces of the past, and seek to learn from them. Instead of pausing to reproduce them, rather let us use them as starting points or springboards from which to leap into the future. — *Louis LaBeaund.*

[1]See reference No. 1 in the bibliography at the end of this article.
[2]See reference No. 2.
[3]See reference No. 3.

WHAT OTHERS ARE DOING

New-Type Vocational School in Baltimore, Maryland

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A type of school offering courses which act in a selective or terminal capacity as conditions dictate.

In accordance with its policy of expanding the program of vocational education, the Board of School Commissioners in Baltimore authorized the opening of a new-type general vocational school for boys at the beginning of the 1936–37 school year.

It was felt that there was a distinct need for a type of school which would accept boys after they had completed the sixth grade of the elementary school, and make available for them a two-year program of shop and related instruction.

The school is distinctly on the secondary level and is designed to furnish terminal instruction to the great bulk of the students, which, at the same time, may be looked upon as preparatory for those students who have the desire and capacity to continue a more advanced and specialized curriculum at the higher Boys' Vocational School.

The new General Vocational School No. 57, therefore, may be looked upon as a bridge or connecting link for some students between the occupational, elementary, and junior high schools on the one hand, and the more advanced Boys' Vocational School on the other. In this sense, School No. 57 occupies a position somewhat analogous to that of the junior high school in the typical academic scheme. It follows that this school, therefore, partakes somewhat of the junior-high-school functions, by giving exploration and guidance, and by providing better articulation between a lower school and a higher school.

In addition to providing this exploration and guidance designed to discover the abilities and interests of the pupils, the school aims to give definite, worth-while, practical vocational training to the great bulk of students for whom the program of instruction will be terminal. While the training is not specialized but general in character, it is of such a nature that the graduate can enter profitable employment in the workaday world. The student will have a requisite grasp of those skills and techniques which will enable him to find his place in and make his contribution to society.

From the administrative angle, the school is justified because it provides training of a proper level and kind for many students who could not do the advanced specialized work characteristic of Boys' Vocational School. Then, too, the per-pupil cost at this latter school is greater than that of School No. 57, hence this new type school, in addition to effecting an economy by selecting the pupils before they get ready for the advanced school, possesses the additional advantage of being in a better position to present instruction and training of the proper kind and level for the student body. A group of teachers in a separate, distinct school plant are better able to adapt the instruction to the needs of such a group.

The organization of the school at present provides for shopwork in light machine-shop practice, woodworking, electrical work, sheet-metal work, and automobile-assembly work. Courses in mechanical drafting and commercial art also are given. Related instruction is given in history, civics, English, shop science, mathematics, trade ethics, guidance, and geography.

Students who have the ability to do precision work take light machine-shop practice, while those who desire to do metalwork, but who do not have the ability for precision, take work in sheet-metal work or automobile assembly. Each student takes two shop courses which are designated as his major and minor shops. He spends three half days each week in his major shop and two half days in his minor shop. One half of the students' time is occupied in related instruction. The school operates on the six-hour day.

Tentative courses of study are being constructed for the two-year period in each subject. These courses will, of course, reflect the general aims and objectives of the school and are planned to emphasize the practical and usable portions of subject matter or phases of instruction with due cognizance of the fact that the training given in the school will be terminal for many of the students. Units of work or jobs are planned to meet the general level of ability of the pupils, and they then proceed to master the work as rapidly as their capacities and abilities warrant. Thoroughness, accuracy, and a high degree of mastery are required of all before the student may proceed to the next unit of work.

At this point in the history of the school, much in the course of study construction is tentative and subject to continual experiment and revision.

A carefully planned extracurricular program is in operation. At present a Model Builders' Club, a Stamp Club, a Hobby Club, and an Athletic Club are in a healthy state of growth and effectiveness. Each class has a homeroom organization as well as a class basketball team. All the extracurricular activities are carefully supervised and sponsored by members of the faculty, but great care is taken not to destroy student initiative and spontaneity in matters of leading and directing the organizations.

Some idea of the student body may be gathered from the fact that approximately 24 per cent of the students work for a salary after school hours; 49 per cent of the homes represented use another language in addition to English; 40 per cent of the fathers, and 30 per cent of the mothers, are foreign-born, and 31 per cent of the fathers are in the common-labor classification. At present, the median chronological age of the student body is approximately 15 years 8 months.

An interesting fact is that 34.4 per cent of the students are 16 years of age or over. These students are over the compulsory-school-law age limit, and a large percentage of them are planning to return next year for the second-year work of the school. Ordinarily, many of this group would have dropped out of school immediately upon reaching the age of 16. The fact that they have remained in school is to some extent good evidence that the school is providing instruction and training in line with their interests and abilities.

While the school is too young to make any definite assertions or predictions as to the ultimate place such a school as Baltimore's General Vocational School No. 57 will occupy in the program of education in the future, there can be no denying the fact that the future seems to be full of great possibilities. At least the critical period of School 57, or the purely experimental stage of its existence, it is felt, has gone by. What the future holds in store for it, only time will tell.

Reorganizing a High-School Shop

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Principal

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A fine description of how the school shop may be turned into a laboratory of industry which will best fit the needs of its students.

Practically all current programs for reorganizing the high-school curriculum include provision for general training in the industrial arts. This trend is the logical outgrowth of such social factors as the development of the mechanical aspects of everyday living, the growing proportion of leisure available to workers in many occupational fields, and the increasing complexity of the modern industrial world. The necessity grows for developing youthful interests in keeping articles about the household in repair, in utilizing handwork as a leisure-time activity, and in gaining an insight into the processes of our industrial organization. Obviously, the situation with respect to the conventional high-school shop calls for new types of materials and activities. In all except the strictly vocational curriculums, administrators and instructors must dispense with inhibiting traditional attitudes and practices, and adopt procedures for training in the activities of everyday living. The present article deals with an experiment designed to realize this objective in a large urban high school.

The Wells High School opened in February, 1935. Since the first week of the opening semester, experimentation has been conducted to develop a shop program conforming to the needs of general education and having special reference to the financial and social conditions prevalent among the people whose children attend Wells High School. Data provided by the guidance clinic of the school show that 34.9 per cent of the fathers of ninth-grade pupils are unemployed; 23 per cent of the mothers are obliged to work outside their homes, and approximately 40 per cent of the families are on relief. More than 80 per cent of the fathers are foreign born, and the use of a foreign language in the home is common. Difficulties of the types enumerated handicap a large proportion of the pupils in pursuing in out-of-school hours, interests developed through activities in the school. Training in shopwork, therefore, which has been found suitable for the needs of everyday living for Wells pupils, may vary materially from that appropriate for more favored communities. The program has aimed to make adequate allowance for a dearth of interests and creative incentives in the school, and a lack of tools and materials for either practical handwork activities or leisure-time pursuits in the homes.

Aims of the Wells Program

In administering the program on an experimental basis, the following policies were adopted. Training in the *mechanical activities of everyday living*, within the limitations of shop facilites, was made the paramount aim. There was, however, no attempt to organize the course on a strictly home-mechanics basis, since it was desired not to inhibit the free functioning of the remaining designated general aims. The effort was rather to provide experiences with tools and materials which would foster the development of home-mechanics skills.

Much of the content of the course is concerned with assisting the pupils to *interpret intelligently the modern industrial world*. Since this is also one of the aims of other subjects within the school, the first consideration was to determine what specific contributions the shop can make. These contributions appear to be: (1) Experience with the fundamental processes necessary to change raw materials into usable commodities, (2) an overview of the evolution of these processes, and (3) a study of present-day practices as a definite contribution toward consumer knowledge.

The shop has approached the problem of *leisure-time activities* with the intention of providing the pupil with opportunities for contact with the materials out of which will grow genuine leisure-time interests. It has been assumed that hobbies in the nature of shop activities are more likely to develop from first-hand contacts with materials resulting in a sense of personal achievement than from an academic study of hobbies or industrial processes. It is probable that the successful building of a model does not denote an interest in the original object as much as it indicates a desire for *personal achievement*. The shop, therefore, emphasizes abundant manipulation and study of materials as the most effective approach to the development of genuine leisure-time interests.

The function of the shop as a *socializing influence* in the general high school has not heretofore received the emphasis it merits. At Wells it has been the practice from the start to utilize the shop to the fullest extent for this purpose. In the shop, as in few other school subjects, each pupil can be brought to realize his individual responsibility with respect to both property and personal achievements. The finished learning products also serve as connecting links between home and school. Many boys of antisocial habits can be oriented in the shop with practices of responsibility and industry after they seem practically impossible of adjustment in ordinary aspects of school and outside life. It would be difficult to cite better grounds for the inclusion of a course in the curriculum in the light of our modern social needs.

Content of the Course

Emphasis is placed on materials owing to the facts that (1) learning comes through experience, yet real first-hand experience with industry is manifestly out

of the question; (2) industry, or the methods of using materials, changes from day to day, while the basic materials remain the same; (3) a first-hand experience with materials should prove a greater asset in buying, owning, renting, or repairing a house or its furnishings than an academic knowledge of industry; (4) hobbies involving handwork are likely to grow out of first-hand contact with materials to a greater extent than from study of industry which is necessarily remote.

1. *Woodwork.* Wood is a paramount material for a number of reasons. It is a material with which the pupil has many contacts in the home. It combines very readily and practically with metal, concrete, and other materials in construction and repair projects. Finally, it lends itself more easily to the manipulative abilities of pupil shopworkers than many other materials.

2. *Metal.* The metalwork in the shop provides for teaching those skills which will enable the pupil to care for his tools with respect to sharpening, heat treatment, protection from rust, and the like. In addition, it is used as the means of securing sufficient interest to induce the pupil to work in metal as a leisure-time pursuit. The projects are of such a nature that the pupil can duplicate them at home without appreciable difficulty.

3. *Ceramics.* Ceramics include such materials as clay, glass, and concrete. Here the shop does considerable experimenting. The pupils are encouraged to use these materials at home, and if forms are required, they make them at school as part of their regular work. Patching a plaster wall, mixing and using concrete, constructing and using potter's wheels, and making castings in plaster of Paris, are some of the activities utilized.

4. *Electricity.* This unit can be made comprehensive, even if limited. Electricity fits in so well with woodwork that the whole class at times works on a project involving both. The aim is to teach the pupil elementary facts and skills which will enable him to perform simple tasks around the home which the average boy or man should be able to do. At the same time, any particular student who has a special aptitude for work involving electricity is given ample opportunity to develop his interests in this field.

5. *Supplementary Materials.* Weaving, basketry, and leather work, and similar materials, are at times incorporated in the shop activities, and may be pursued by small groups or individuals as needs and interest indicate.

Methods of Instruction

Units of learning. The content of the industrial-arts course, in common with other subject fields in the general curriculum at the Wells High School, is organized in units under functional "centers of interest." Accordingly, each unit of shopwork contributes to one of these social functions; for example, "How the industrial arts contribute to school activities" is the chief learning objective of the unit organized under the first center of interest entitled "The school." Other centers of interest in grade 9B are "The home," "The local community," and "The metropolitan community." In grade 9A they are "Conservation of our cultural and material resources," "Our changing methods of production and distribution," "Governmental and social agencies in co-operative living," and "Work in relation to everyday living." Each unit in turn is organized under the headings "unit elements," "approaches," "activities," "materials," and "outcomes."

The approaches, activities, and use of reference materials in these units provide opportunities for realizing the general aim of interpretation of modern industry. They furnish the means for instilling the fact that tools and processes, like other institutions of society, are the results of a long process of evolution. Also, the activities are so arranged and graded that the acquirement of necessary facts and skills is effectively accomplished.

Small-group and individual activities. The method chiefly utilized is a combination of the individual and small-group-techniques. Whether the pupil is working on an individual or group project, he is a member of a small group of boys co-operating with a pupil foreman and using a common kit of tools. In this group work, the pupil learns the essentials of good teamwork — the necessity for him to take responsibility for an assigned portion of the project, and to carry out his assignment effectively and on time. He sees that the success of the group and its work depends on his contribution. Individual projects are interwoven with those of the group. Here the pupil develops a sense of economy in the use of tools and materials, since delays in a group project, such as waiting for certain tools, or for glue or paint to dry, are compensated for by work on an individual project intended for use in the home.

Considerable latitude is allowed the pupil in the choice of individual projects. Self-analysis by the pupil of his personal abilities and limitations is especially encouraged. Likewise, he is stimulated to make accurate estimates of time, materials, and costs of individual projects which he undertakes. As far as is consistent with effective instruction, each enterprise is self-administered.

Socializing class procedures. Considerable attention is given to development of pupil participation in the management of group activities. During the first week of the semester, a class foreman and a foreman for each small group are selected. At intervals of approximately two weeks thereafter, the "foremanship" of the groups is rotated until each pupil has experienced the responsibilities of management. Each group is then permitted to elect its own foreman who serves until the close of the semester, or until such time as change is needed. The class foreman is appointed in some classes, and elected in others, depending on the stage of social responsibility attained by the class.

The small-group foremen recommend the individual assignments in group activities, and check on the progress of the work. Prior to the assignment of group projects which are new or especially difficult, group foremen are called into conference with the instructor and are given detailed instructions and group job sheets to use in carrying out the work. The foremen are responsible for securing necessary materials, and reporting on the condition and security of the tools in the kit used by their groups.

Industrial laboratory atmosphere. From the start, the aim has been to produce the atmosphere of an industrial-arts laboratory rather than that of the conventional wood, metal, or electric shop. The benches have been arranged to fit the needs of the various materials, and especially to facilitate small-group activities. A case to contain the group tool kit has been constructed and fastened to the wall close to the bench where each group works. These units approximate the atmosphere of home workshops. Job sheets for individual and group projects, and necessary blueprints and designs are posted where most convenient for reference. The blackboard, that much neglected but highly indispensable visual aid, is effectively employed for illustrative purposes. The bulletin boards are utilized to invite attention to schedules, new devices, and significant reading references.

The ideal setup for the industrial-arts laboratory also includes a small forge or an electric furnace, an anvil and its attendant tools for bending and shaping, three or four vises for metalwork, small metal-top tables similar to sand tables for ceramic work, and facilities for constructing and using a potter's wheel.

Industrial-arts library and conference room. The glass-enclosed finishing room, designed to permit the instructor to oversee the work of the entire shop, has been fitted up as a combined library, group-demonstration, and conference room. Shelves for books, and benches to accommodate small groups of boys, have been

installed. The materials of the library consist of books on shop and crafts projects, various textbooks, industrial-arts magazines, and visual aids. This library has been found useful in group conferences and demonstrations, and provides means for training boys engaged on individual projects, in laboratory methods of work.

Developing Home Workshops

The industrial-arts laboratory also has set for itself the important aim of developing the home workshop. It was felt that chiefly in this way would the instruction and activities of the laboratory effectively materialize into leisure-time pursuits and practical repair activities about the home. The development of such a policy was handicapped by lack of tools and other facilities in the homes, and lack of parental interest. Two measures undertaken in the shop, however, have done much to arouse interest in, and initiate, shop activities in the home.

Individual model tool kits. The construction of model tool kits was made a small-group project with the view of providing tools for use in the homes. Each group was assigned a different type of model building tool kit. A representative list of assignments is as follows:

Group A — Model airplane (flying model).
Group B — Model airplane (non-flying model).
Group C — Model boat (sailing model).
Group D — Model boat (decorative type).
Group E — General craft kit.

Each group was required to decide what tools were essential for the assigned kit, and to plan and construct a case large enough to hold them.

A circulating library of tools. When completed, the model kits have constituted, in effect, a circulating library of tools for use in the homes. Pupils are permitted to take the kits home for overnight or week-end use. First, however, they must present a plan of what they intend to construct with them, and later give account of their progress. Judging from the requests for advice regarding uses of tools and organization of workshops in the homes, and the number of workbenches and other shop equipment constructed for home use in the school shop, a much-desired stimulus has been given to the development of the home workshop.

Industrial Arts at Augusta, Wisconsin

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The description of a one-man industrial-arts department in the high school of a small community.

"Industrial Arts as a school subject has passed through two somewhat well-defined periods of professional growth and is now in the midst of a third. The first was 'Manual Training' where the emphasis was on hand skill, chiefly in woodworking. The second was 'Manual Arts' where the emphasis while still on skill, was extended to include the making of both useful and well-designed articles. The third is now 'Industrial Arts' where the intent is to include all of the old that was good and considerably more to meet certain basic needs and interests of everyone in an industrial civilization, regardless of his age, race, sex, intelligence, or social status."

The foregoing statement by Dr. William E. Warner in the February, 1936, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION points out a philosophy which is followed at the High School at Augusta, Wis., where the writer introduced a "one-man" industrial-arts department.

The Augusta High School offers industrial education from the seventh through the eleventh grade for boys, and, in addition, offers one year of work for girls on the senior-high level. The chart in Figure 1 shows the organization and range of work taught.

In the junior high school where, almost 100 per cent of the boys take shop or drawing courses, six one-semester courses offering a good range of basic industrial "knowing and doing units" are listed. These courses are general in nature and include a scattering of material in each of the four fields represented. However, they are not "home-mechanics" courses, and it is the opinion of the author that, at least in the lower grades, the work should not be spread over too large and varied a list of experiences, since the aim is to develop an understanding and appreciation of good workmanship and design, and the ability to plan and carry through a project to its completion. This does not mean that the students are all on the same process at one time and that they have no choice of activity. On the contrary, the projects are often changed and kept up-to-date with an eye to changing student interests and experiences. However, in the last analysis, the projects are selected by the teacher to meet the objectives of the course and great variations are the exception rather than the rule.

In the senior high school, the objectives of the work change somewhat and the standards of workmanship go higher and cover a wider range of activity. The work in these last years of high school is advanced enough so that the boy of good general intelligence feels that he is getting something worth while. Under no condition is the department at Augusta allowed to become the dumping ground for more than the average percentage of slow students. Textbooks or instruction sheets are used with outside assignments in all of these courses, and there is an occasional student failure.

FIRST SEMESTER	SECOND SEMESTER
7th Grade ELEMENTARY WOODWORK	7th Grade ELEMENTARY DRAWING
8th Grade PRACTICAL ELECTRICITY	8th Grade GENERAL METAL
9th Grade GENERAL DRAWING	9th Grade GENERAL WOODWORK
10th Grade ADVANCED GENERAL DRAWING, PRINTING, AND DUPLICATING	10th Grade GENERAL METAL
11th Grade GENERAL SHOPS WOOD, DRAWING, METAL ELECTRICITY, CONCRETE UPHOLSTERY, BOAT BUILDING	11th Grade CONTINUED FROM FIRST SEMESTER
INDUSTRIAL ARTS FOR GIRLS	
SHORT UNIT SHOPS WOOD, UPHOLSTERY, WOOD FINISHING, ELECTRICITY	CONTINUED FROM FIRST SEMESTER WITH THE ADDITION OF GENERAL DRAWING

Fig. 1. Organization and range of shopwork

Printing and Duplicating

The unit of work called "Printing and Duplicating," is given in the first half of the tenth year. The school owned a mimeograph, a "Ditto" or roll hectograph machine, and a rubber-type press suitable for hand bills and the like. This equipment was moved to the school shop and instruction given during the semester in the preparation of master copies, stencil cutting, typesetting, blueprinting, and bookbinding with about 25 per cent of the time spent in related information. Results of this experiment with its added field of study and sampling of more of the world's work, together with its extreme practicality in the school will, no doubt,

lead to its continuation as a part of the regular instruction. Almost any school could offer such work without much outlay of money, and perhaps with an actual saving on the school printing bill. It is a help to the teachers who write and duplicate assignment sheets and the like, and these duplicating jobs help in giving a practical atmosphere to the work in the shop. These jobs should come into the department in time so that they can be handled as instructional practice work following the demonstration and in the regular order of school business.

General Metal

The metalworking courses offered are very general in nature. The work is practical, yet the projects are designed to include many processes, many metals, and many constructions, designs, etc. Like the other subjects, metalworking gives experience and skill in a field of practical work and contributes to the general objectives of all industrial-arts work such as appreciation of good workmanship and design, habit of orderly method of procedure, knowledge of how to care for and use properly the things we buy, etc. It also gives, as do the other subjects, a practical approach to the related information that should be taught in close relationship with the manual processes. The chart shown in Figure 2, shows how one small skill in the course can contribute to the boy's general education. This chart is given only as a sample of what can and should be done with all of the fundamental operations.

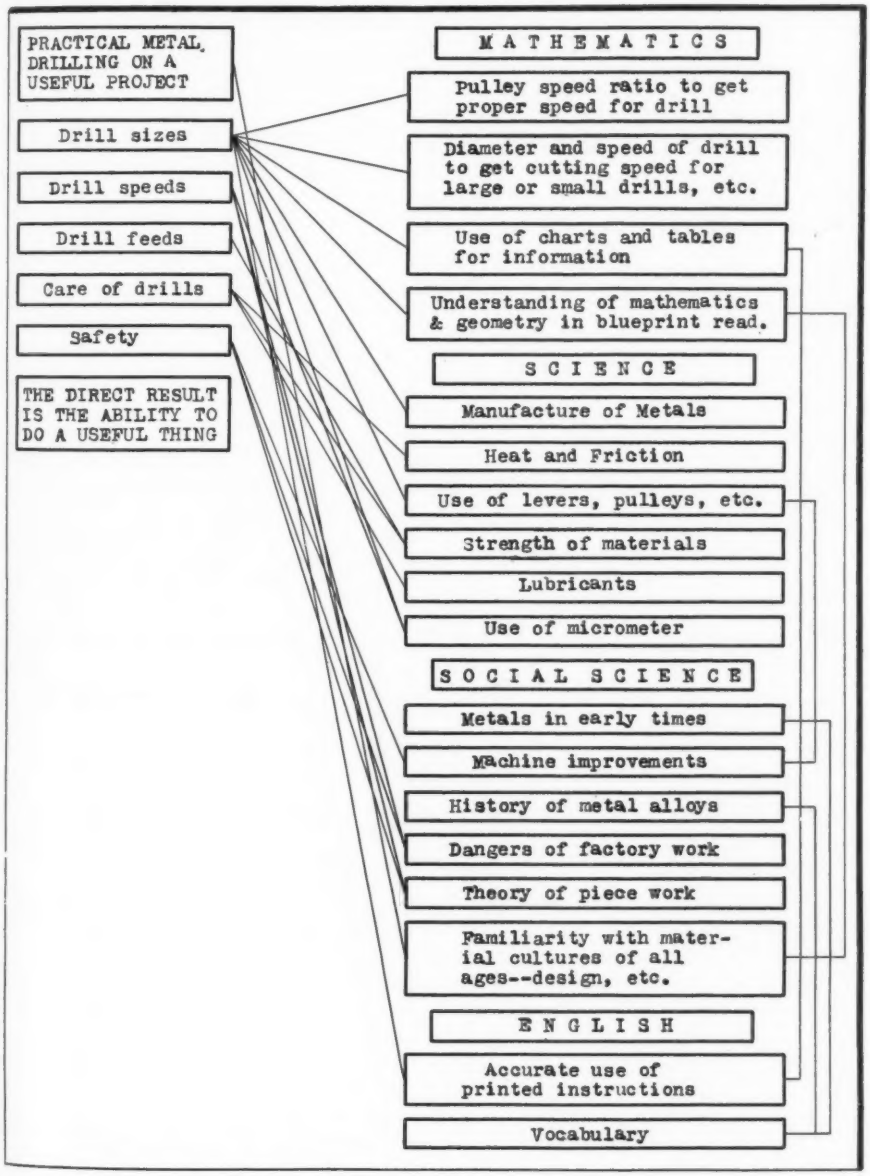

PRACTICAL METAL. DRILLING ON A USEFUL PROJECT
Drill sizes
Drill speeds
Drill feeds
Care of drills
Safety
THE DIRECT RESULT IS THE ABILITY TO DO A USEFUL THING
MATHEMATICS
Pulley speed ratio to get proper speed for drill
Diameter and speed of drill to get cutting speed for large or small drills, etc.
Use of charts and tables for information
Understanding of mathematics & geometry in blueprint read.
SCIENCE
Manufacture of Metals
Heat and Friction
Use of levers, pulleys, etc.
Strength of materials
Lubricants
Use of micrometer
SOCIAL SCIENCE
Metals in early times
Machine improvements
History of metal alloys
Dangers of factory work
Theory of piece work
Familiarity with material cultures of all ages--design, etc.
ENGLISH
Accurate use of printed instructions
Vocabulary

Fig. 2. Showing how the industrial arts contribute to general education

General Shops

Instead of placing the diversified type of general shop in the lower grades, it has been reserved for the last year of the work at Augusta. Much of the literature written on the general shop seems to indicate that it is offered as one of the first courses at the junior-high-school level. Judging by the objectives, however, the writer believes that the general shop course where the boy is expected to use a variety of tools and materials, and to work in a number of fields with a minimum of class instruction should come after he has passed through a series of individual shops. (The term "individual shop" as used here refers to the individual fields of work even though the content covered may be as general in nature.) It is in this advanced general shop that the industrial-arts field can be covered, from canoe building to electricity; from upholstery to concrete casting; from drawing to ornamental iron.

Industrial Arts for Girls

Industrial arts for girls probably needs no special introduction here. The October, 1935, issue of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine, and also the March, 1935, issue of the *Wisconsin Journal of Education* contained articles which describe this work for girls. Many of these courses are being taught in other places. Mixed groups, however, are not popular except in special elective courses.

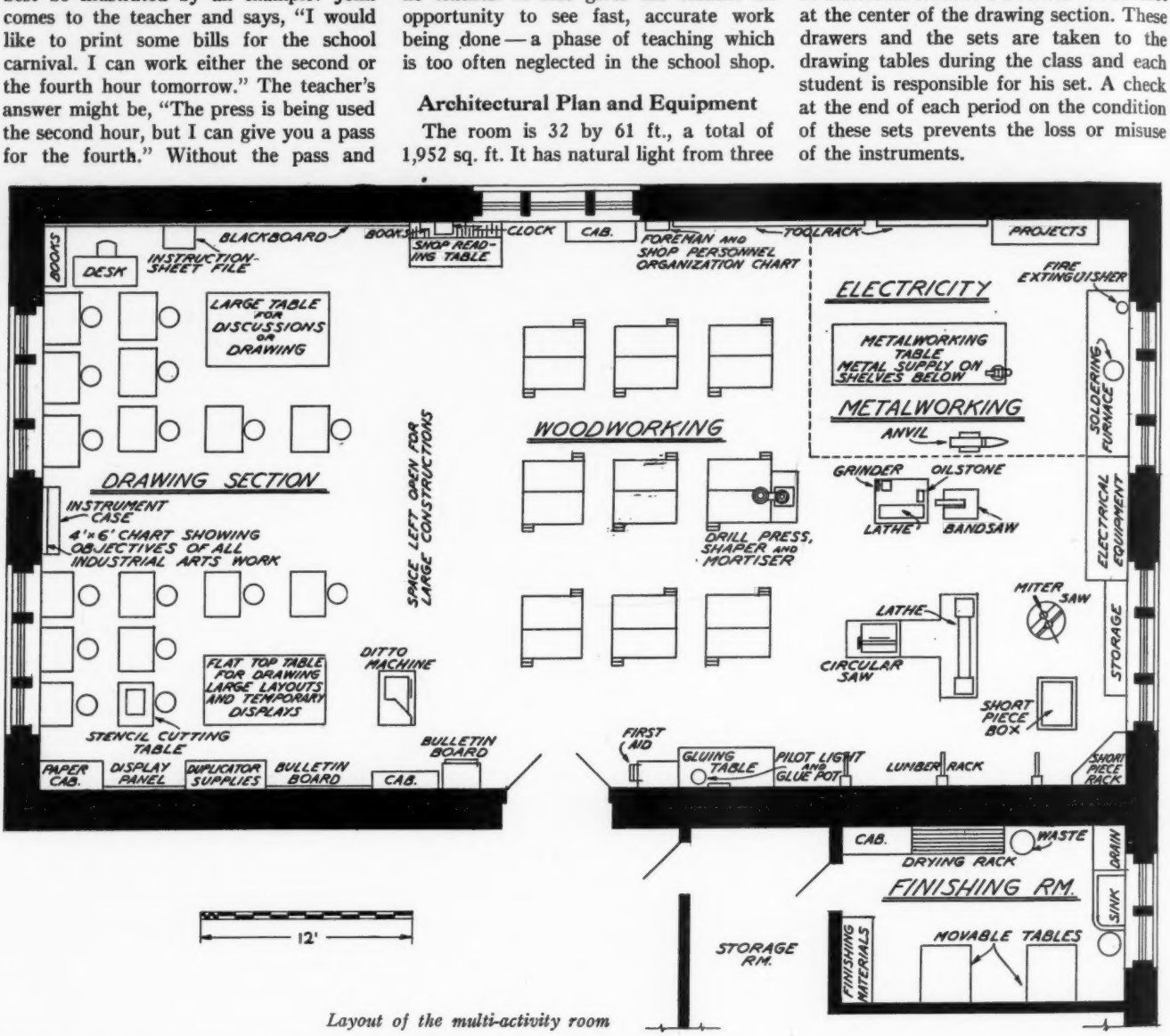
Reference Work

A student library and reading table is used in the department and each class is assigned reference work from the books, periodicals, and pamphlets. This system seems to be more satisfactory than that of using the school library. With the books in the shop, the instructor and the students can have access to them at any time. The teacher also has a better opportunity to form an idea of the study habits of his students. There can be no doubt but that the new industrial-arts courses with their aim of "diversity and enrichment" will have more and more use for the cultural and artistic, as well as the technical values that can be gained from the many good books and magazines of today.

The Pass System

Since this is a one-man shop and almost all of the activity is carried on in one room, there would ordinarily be no chance for a student to use the shop except during his class hour. It has been found, however, that by controlling the number of students and the kind of work that the

various departments have, the whole shop can be in use all of the time. This can best be illustrated by an example: John comes to the teacher and says, "I would like to print some bills for the school carnival. I can work either the second or the fourth hour tomorrow." The teacher's answer might be, "The press is being used the second hour, but I can give you a pass for the fourth." Without the pass and



Layout of the multi-activity room

definite arrangement, John would not be allowed to leave the study assembly for the shop. On certain days and during some hours, we have as many as thirty extra boys in the shop. These boys receive a minimum of attention from the instructor as he is engaged in teaching another class, yet they are under supervision and can receive information or help when it is needed.

Demonstration Projects

Each year the author has made it a practice to build some project which required more skill and knowledge than anything the students attempt. This serves a twofold purpose. First, the various constructions, materials, and designs can be used as illustrative material. Second, the students have more confidence in a teacher who shows a genuine interest in the subject he teaches. It also gives the student an opportunity to see fast, accurate work being done — a phase of teaching which is too often neglected in the school shop.

Architectural Plan and Equipment

The room is 32 by 61 ft., a total of 1,952 sq. ft. It has natural light from three sides and over thirty light sockets, many of which can be turned on or off independently. This results in good light where it is needed. All radiators are hung from the ceiling, and the windows are 5 ft. above the floor so that it is possible to use the wall space all of the way around the room.

The finishing room has a sink and drain, hot and cold water, and ample cabinet space. This room can be kept free from dust.

The drawing section has the desks facing the south windows which have frosted glass — a desirable feature because it does away with cross-lighting which is so trying on the eyes. The equipment consists of 16 student tables, and two large tables which can be used for drawing when classes are large. All drawing tools except T squares and drawing boards are kept in individual student drawers in the cabinet at the center of the drawing section. These drawers and the sets are taken to the drawing tables during the class and each student is responsible for his set. A check at the end of each period on the condition of these sets prevents the loss or misuse of the instruments.

The central part of the shop is equipped with 18 standard woodworking benches, an electric glue pot, and a supply cabinet. All tools are kept on the tool rack which is easily kept in order and no tools are lost. A large space 10 ft. wide at the side of the benches is a desirable feature as it can be used for a working area when special projects of large size are under construction. This space has been successfully used for canoe building and many special jobs which are of educational value to all the students, that come into the shop. The personnel-organization chart is hung up on one of the side walls, and gives a mechanical means of rotating the shop foreman and personnel, and fixes the responsibilities assigned to each student.

The metalworking section has a concrete

floor (shown in the illustration by the dotted line). This department has an anvil, mechanics' vise, portable soldering torch, grinder, and the regular bench and sheet-metal-working tools. The drill press is used by both the wood and metal groups. It is a standard machine that can be used for mortising, shaping, or sanding. The students do part of their work on the wood-working benches which join this section of the shop. The large bench with its metal-storage feature is described in the August, 1935, issue of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine.

The electrical equipment and supplies are kept in a cabinet close to the soldering and metalworking benches. The lead-casting and battery-charging outfits can be set up when needed on the soldering table which has a slate top and has the proper electrical outlets.

Although the industrial-arts departments in schools the country over were the subjects for severe criticism during the worst years of the depression, the work for the last three years has again been growing in the esteem of the public. In 1933, the shop at the Augusta High School became self-supporting and will remain so with the exception of additional equipment. This fact alone presents a good argument in favor of retaining the course.

Considerable work has been done by means of downtown window exhibits and newspaper articles to show the place of industrial arts as part of the general education program for all American boys.

Organization of Related Subjects

Arthur A. Dick

High School,
Barton, Maryland

A method of analyzing and making the related work function with the shopwork in the industrial-arts department.

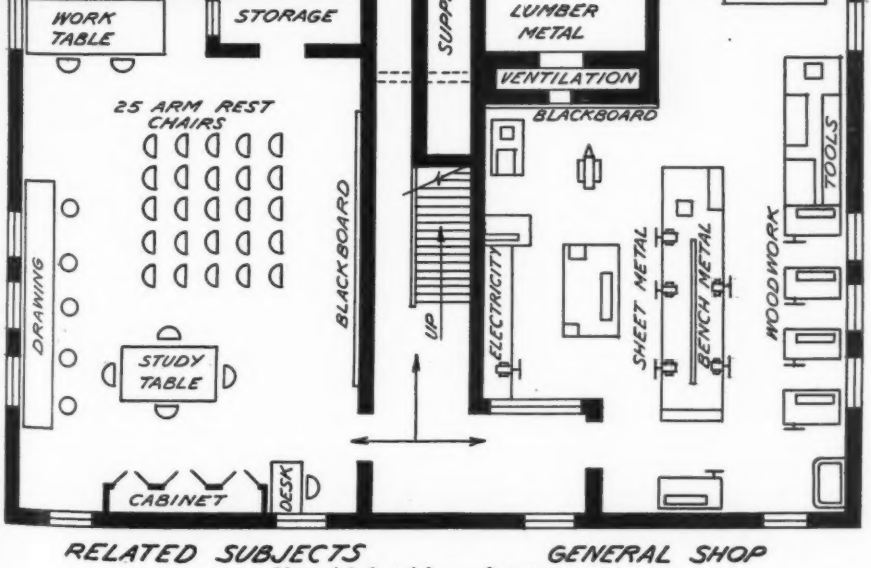
The Barton High School industrial-arts department at the junior-high level, is definitely organized on an interrelated parallel basis. This is clearly exemplified by the physical arrangement of the general shop with the related-subjects room by the close relationships between the activities of the general shop and the activities of the related-subject program, and by pairing off the technical information and techniques of the shop with the general industrial information of related subjects.

This parallel treatment can be readily detected by a study of the charts; first, the "Plan of Industrial-Arts Department"; second, the "Organization of Industrial Arts"; and third, the "Division of Content for Parallel Organization."

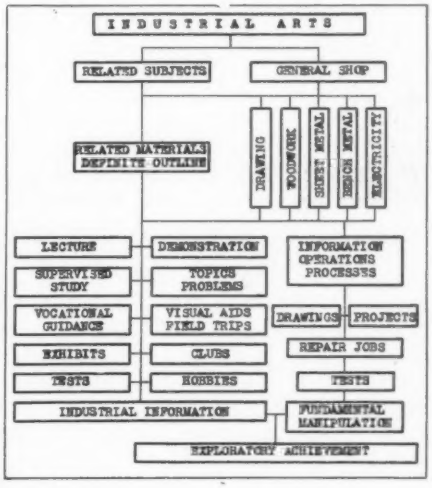
It is a plan perhaps best suited for the smaller high schools having a general shop. Also, it is understood that this plan is in an experimental stage.

Before presenting the content of related-subject matter in electricity, it is necessary to point out that the same parallelism can be and should be worked out for the technical information. This article, however, deals only with related-subject matter because much has already been published on how to organize the technical information that should accompany the shopwork in the school.

The following distinction is to be made: *Related-subject matter* is industrial information which the boy should know, but which is not necessary in the making of a project. *Technical information,* on the



Plan of industrial-arts department



Organization of industrial arts

Division of Content for Parallel Organization

Related Subjects	*General Shop*
1. Make drawings	1. Projects in woodwork, sheet metal, bench metal, electricity
2. Construct models	2. Repair jobs
3. Work on hobbies	3. Care of tools, machines, and equipment
4. Study blueprints	4. Learn about processes and operations
5. Job-sheet study	5. Apply technical information
6. Study projects and topics	6. Experiment and explore
7. Study industrial information	
8. Work problems	
9. Definite industrial-academic classwork	

other hand, is information that is necessary for the boy to know in the making and utilization of a project. Naturally, there is much overlapping between related-subject matter and technical information. Related-subject matter is taught to all the class, while technical information may be taught either to the individual or to the class. Related-subject matter is taught in a routine order, while technical information is given as the occasion demands.

At the present time, an average of about 25 per cent of the time is taken for related subjects. The related-subjects room has a great deal of visual-instruction• material posted on the bulletin boards and walls. Also, an adequate library of reference books, magazines, and pamphlets.

Each student in a class is given a choice of one or more of the topics, as shown on the list "Related-Subject Matter for Electricity." The student looks up the topic in one of the information sources of the related-subjects library and has it ready in the form of notes. When a student gives his topic, he may have pictures or illustrations to supplement his notes. The class may add additional information and a class discussion may result. The teacher also adds from his knowledge and experience.

The following procedure is used when a student is ready to start on a project. Assume that the boy is to make an electric magnet. Referring to the checking chart, the student will come to the teacher and say, "My next job is an electromagnet." The teacher will give the student a reference on magnetism and magnets, to be studied in the related-subjects room. When the student has finished his reading, he studies the job sheet on how to make an electromagnet. Then he makes the magnet and tests it for function. The student then brings the finished magnet to the teacher for checking. The teacher tries it for function, and asks such questions as:

1. What are the poles of a magnet?
2. What is magnetism?
3. Why did you make this magnet?
4. What are electromagnets used for in industry?
5. Is this magnet temporary or permanent?

If the teacher is satisfied with the answers to the questions and to the performance of the magnet, credit is given the student on his progress chart. The procedure may be summarized as follows:

1. Study by student of related and technical information concerning project.
2. Study job sheet or drawing.
3. Make project.
4. Teacher checks project, and questions student.
5. Teacher credits pupil with finished project.

This shows how the two rooms are utilized in the completion of a project, and the study of the required related and technical information for an individual student.

The class division may be of interest.

Related-Subject Matter for Electricity

(Information that a boy *should know,* but which is not necessary in the making of an electrical project.)

Electricity

A. Development of Electricity
   1. Derivation of names
      a) Electron
      b) Magnet
   2. Artificial magnets
      a) Lodestone
      b) Magnetite
   3. Compass development
   4. Theories
   5. Earth as a magnet
      a) Affects surveying
   6. Experimental laboratories
   7. Creation of new fields

B. Men Associated With Electricity
   1. Volta
   2. Ampere
   3. Ohm
   4. Watt
   5 Franklin
   6. Edison
   7. Steinmetz

C. Electricity as a Source of Power
   1. Mechanical and chemical production
      a) Mechanical — water power, steam, gas engine
      b) Chemical — battery, dry cell
   2. Means of transmission
   3. Used for industry and manufacture
   4. Dams and water power — how electricity is produced

D. Electrical Inventions and Progress
   1. Photo-electric cell
   2. Television
   3. Refrigeration
   4. Sound equipment
   5. Lighting
   6. Telephone
   7. Radio
   8. Artificial lightning
   9. Automatic controls
   10. Ocean cables
   11. Signal devices
   12. Refining and electroplating
   13. Aviation control

E. The Future of Electricity
   1. Prediction or prophesies
   2. New fields — electro-chemistry, radio, television
   3. Advancement in twenty years
   4. Government control — for protection

F. Design in Electricity
   1. Electrical equipment
      a) Motors
      b) Light fixtures
      c) Telephone
      d) Radio
   2. Effects on home construction
   3. Use in electrical advertising

G. An Aid to the Medical Profession
   1. Static machines
   2. X-ray
   3. Fluoroscope
   4. Electrical surgery
   5. Electric-current response
   6. Ultra-violet rays
   7. Magnets — Removal of metal fragments

H. Control, Safety, and Protection
   1. High-tension wires — Dangers and accidents
   2. Rules of safety
   3. Underwriter's regulations
   4. Standard codes
   5. Licenses
   6. Terminology
   7. Broadcast stations

J. Can Raise the Standard of Living
   1. Labor-saving devices for the home
   2. More time for leisure
   3. Automatic controls
   4. Radio education
   5. Public education

K. Occupational Information
   1. Opportunities offered
   2. Education required
   3. Different branches
   4. Qualifications needed
   5. Attitudes and ideals

L. Sources Where Related Information Can Be Obtained:
   1. All encyclopedias — a very good source
   2. Literature from electrical companies
   3. Men in the electrical field
   4. Books on electricity and science
   5. Magazines
   6. Teacher's knowledge and experience

Related-Subjects Information Sheet

Electricity

A. Advanced Project — optional
   *Carbon Arc Lamp**
B. Types — a.c. and d.c.
C. Practical uses:
   1. Lighting
   2. Therapeutic
   3. Source of rays — ultra-violet, infra-red
D. Industrial uses:
   1. Testing paints, varnishes, and other protectives by ultra-violet exposure
   2. Treating tobacco by ray exposure
   3. Treating dairy herds, and irradiating milk
   4. Blueprints
E. Supplementary information
   1. Mercury quartz tube arc — comparison with carbon arc
   2. Spectrums for determining types of rays
   3. Angstrom units
   4. Qualities of quartz glass

Related information for this project can be secured from:
1. Encyclopedias
2. Science books
3. National Carbon Company
4. Lamp manufacturers

*An excellent project for students in simple experimentation and research.

The class size is about 25 students. An average distribution will be as shown. Sixteen boys will be working on various activities in the general shop: four on sheet metal, four on bench metal, four on woodwork, and four on electricity. The other nine will be in the related subjects room: four on drawing, two or three on models, and two or three using the study table. One instructor takes care of both rooms.

The drawing is in the related-subjects room so as to be away from the dust and noise of the general shop. Also, drawing is definitely related to the other shop activities so it can be classed as a related subject.

We have had success with the building of model airplanes in a number of ways. There are a few boys who find drawing difficult either through lack of ability or lack of interest. Some of these boys were given an opportunity to make flying models of airplanes, using a working drawing and following written instructions. These boys produced accurate models, learned to read a model-airplane drawing and to follow written instructions in spite of themselves. In these cases, the results can be attributed to the natural interest factor in model building.

The aim of this organization is to stress related-subjects matter as a means of keeping abreast of industry. It is impossible to do this through project teaching alone. In this day, it seems that a broad industrial knowledge is much more important than a single manipulative skill. At the expense of a great deal of labor, we can, through a process of synthesis and analysis, take each project in all the activities and pigeonhole the related industrial information that goes with it and its construction. In this way, we can get away from the conventional project making, and build a new industrial-arts curriculum suitable for the present age.

Through the use of the preceding organization, the following results and factors have been noted:

1. Material costs for project purposes can be reduced because more time is devoted to industrial and technical information.

2. In this organization, there is *something* every boy can do that will be of value to him in later life.

3. The course content is varied to a degree to take care of *either* the academically or mechanically minded boy.

4. The boy is in an environment where he will absorb information whether he wants to or not.

5. The recognition that so-called *repair jobs* for the home or school may be of more *real* and *practical* value than conventional projects.

6. A teacher of general shop with a definite related-subjects program must be well informed and versatile.

7. Adequately to include sufficient related-subjects matter in the course, a fifty-fifty division of time may be the prospect.

Industrial Arts at Catonsville, Maryland

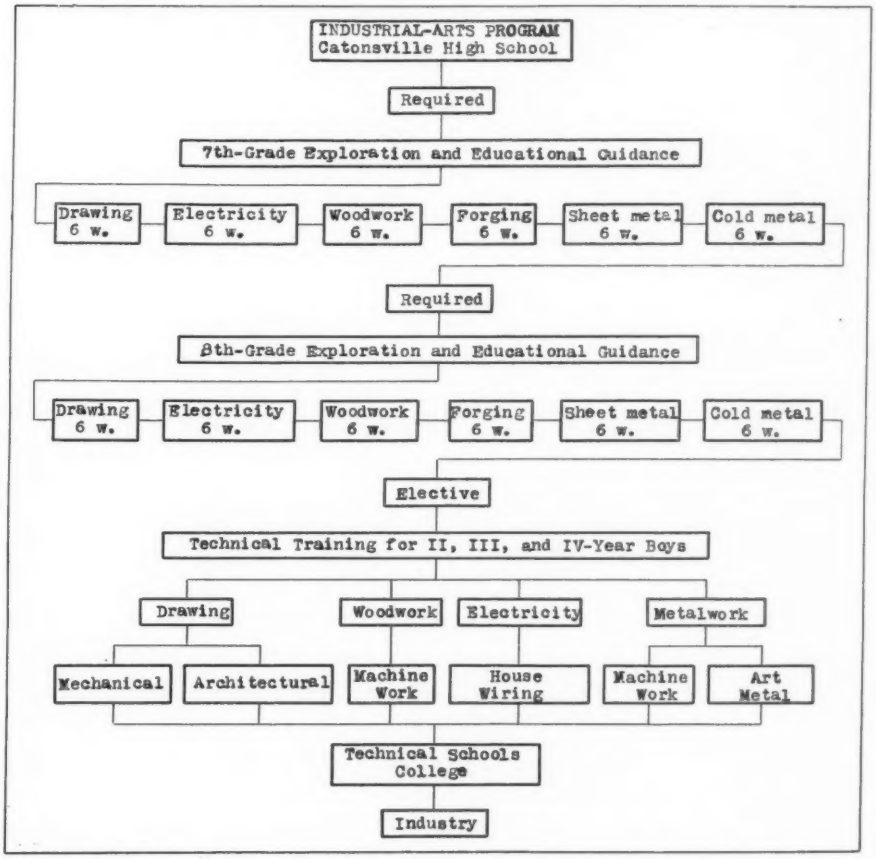
Elmer K. Zeller

Catonsville High School,
Catonsville, Maryland

The industrial-arts program in a city of 15,000 to 16,000.

Since the seventh-grade students in this community receive their instruction in the high-school building, it has been a very simple matter to develop a junior- and senior-high-school program for industrial-arts work in our school.

Boys in the seventh and eighth grades are at that period in life when they should be making wide contacts with objects, materials, and with information about occupations at which men make their living. A general-shop program is therefore offered in our school, to give these contacts to our students. Under our present system, six different activities or fields of work are offered in the seventh and eighth grades through which the students are rotated, spending approximately six weeks in each. These six different activities are taught in three different shops and by well-trained instructors. Seventh-grade classes meet for a one-hour period on Monday and Tuesday one week, and Monday, Tuesday, and Wednesday the next, thus allowing two different seventh-grade classes to be cared for during the same period in the week. According to the state law, the eighth-grade students must spend three one-hour periods in the shop each week in order to earn a half credit. There is a prescribed course for each activity including as much technical and related information as possible along with a variety of projects from which a



boy may select the one he has the greatest desire to make. The major emphasis in the seventh- and eighth-grade courses is placed upon the related information and not so much upon the quantity and quality of work done. However, a degree of skill naturally enters into all of the work which is required of the students. These exploratory efforts on the part of the boy reveal to him his abilities and aptitudes for mechanical things and after completing the eighth-grade course, he will be able to arrive at a more or less definite conclusion as to the type of work for which he is best suited. He can, therefore, more intelligently select the courses he should pursue during his stay in high school. The boys in the seventh grade are required to pay a shop fee of thirty cents for the year's work and the boys in the eighth grade are required to pay a fee of sixty cents, for they make larger projects and use more material. This money is paid at the school office and not to the shop instructor.

Industrial arts is required only in the seventh and eighth grades (the eighth grade is our first year of high school), and it is given for exploratory and educational guidance purposes.

In the second, third, and fourth years of high school, industrial arts is offered for a far different reason and is purely on an elective basis. Those boys having special mechanical ability, and those anticipating higher technical training after graduation are encouraged to continue their work in industrial arts. Special courses also are open to those boys who because of circumstances will perhaps be unable to finish high school and must seek employment. The advanced courses offered are: Mechanical drawing, architectural drawing, millwork, electricity, machine shop, and art-metal work. The boy is permitted to select any one of these courses and is allowed to remain in that shop during the entire year. The principal objectives of the courses are to impart as much technical and occupational information as possible and to develop a high degree of skill in the use of tools and machines. Boys taking such courses meet for a one-hour class period each day and receive three fourths of a credit for their work. Due to the fact that the projects made by such students are so varied, and some boys use so much material, they are asked to pay for each project instead of paying a set fee for the course. The Baltimore County School System keeps the shop adequately equipped with tools, machines, reference books, materials of instruction, and teachers, and in return it asks the students to pay for a part of the material they use, as the completed projects have commercial value.

COURSES AND INSTRUCTION SHEETS

Individual Instruction Sheets

Burton T. Williams
Industrial-Arts Instructor,
Roosevelt Junior High School,
Beloit, Wisconsin

An evaluation of some of the standard objections raised against the individual instruction sheets.

Although instruction sheets have become one of the standard methods of shop teaching, they have been criticized adversely by many people. The chief objections raised against instruction sheets may be summed up as follows:

1. They tend to reduce the work to a correspondence course.
2. They give the teacher too much extra time to read papers and magazines at his desk.
3. They do not give the pupil a chance to analyze the job and find out what is to be accomplished.
4. All instructors are not equally capable of writing instruction sheets.
5. They take away the pupil's opportunity to plan the doing of a job.
6. Reliance on student's interpretation of the instruction sheet tends to make tools and equipment suffer.
7. They undermine shop discipline.
8. They lower the standard of workmanship.
9. By using instruction sheets, good teachers may be replaced by poor ones.
10. Good textbooks and reference books are displaced.
11. They do not fit individual needs and differences.
12. Interpretation of written instruction is difficult for many pupils.
13. Reading much typewritten material is uninteresting to the pupils.
14. Danger of accidents is increased because less personal attention is given the students.
15. They require the teacher to take valuable time for checking, writing, and revising, and thus make a clerk of him.

This list of objections represents only a few of the many pointed out by critics on the subject, but it is a fair representation of the types of arguments used. Let us consider some of these points as they are presented.

1. The instruction sheets appropriate some of the good qualities of a correspondence course and combine them with lecture and demonstration methods. Although Ericson[1] points out that they tend to reduce the work to a correspondence-course level, he also shows they have proved their value as an aid to the teacher.

2. The use of instruction sheets releases extra time which a poor or mediocre teacher might waste, but such a teacher has no place in the shop of today. Such a teacher's negligence can in no way be ascribed to the instruction sheet. The progressive teacher will utilize the extra time gained in a manner profitable to the class.

3. The objection that the pupil does not have a chance to analyze the job cannot be maintained when the instruction sheets have been carefully constructed and are used properly. In fact, they require a pupil to analyze jobs and instructions that he would not need to do under other methods.

4. All instructors are not equally fitted to write instruction sheets any more than they are equally prepared or able to teach. Instruction sheets prepared by a superior teacher would enable the inferior teacher to do better work. There are many instruction sheets available, such as those of Tustison, Bedell, and others, which might well be used and studied.

5. Good instruction sheets do not take away the pupil's opportunity to plan a job, but rather help and guide him. Frequently, he must plan his job as a part of the work assigned by the instruction sheet.

6. The time saved by the use of instruction sheets should enable the teacher to keep tools and equipment in first-class condition and give him an opportunity to spend more time supervising the students in the proper use and care of equipment.

7. It is not the purpose of the instruction sheet to take care of classroom discipline. However, good sheets properly used will increase the interest of the individual and keep him at work during the time he would otherwise be waiting for instruction from the teacher; thus, they indirectly reduce the discipline problem.

8. Standards of workmanship would be lowered if the teacher depended entirely on the instruction sheets to teach the class. The purpose of these sheets is to aid the teacher, not to supplant him. When used as a means of checking or clarifying a teacher's demonstration, the instruction sheets serve as checking levels in the progress of work. By giving

[1] Ericson, E. E., "Job Sheets and Personal Instruction," *Industrial Education Magazine*, 27:291, March, 1926.

the pupil a ready reference to help and guide him, instruction sheets should tend to raise the standard of workmanship rather than lower it.

9. If the instruction sheets make it possible for a poor teacher to replace a good one, then, with the good teacher using them, we can expect still better teaching. However, as Mr. Phillips[2] says, "These devices are valuable aids in teaching; but just as they make possible better and more effective teaching, they call for superior teaching ability and experience." The progressive teacher uses the individual instruction sheet as an aid to the other methods of teaching and not as an end in itself.

10. While the individual instruction sheets may take the place of some textbook work, their proper use will, however, encourage the use of good textbooks. By directing the student's reading, they help him find the information he needs successfully to analyze and plan his job. The use of individual instruction sheets will make several copies of carefully selected reference books adequately serve the supplementary needs of the student.

11. A poor instruction sheet, like a poor demonstration or a poor lecture, may not fit the individual needs and differences of pupils; but Fryklund[3] points out that individual differences are overcome by instruction sheets and that their use does not reduce the whole class to the level of poor thinkers. Van Westrienen[4] says they serve the needs of students of varying abilities and cater to individual differences through a variety of optional and graduated assignments.

12. The belief that interpretation of facts from printed material is a special ability possessed by only a few individuals is not based on scientific truth.[5] All individuals possess all types of abilities to a greater or less degree and need only to be subjected to proper experience to attain their limit of development. The instruction sheet is good for developing reading habits. Fryklund[6] lists two specific reasons: (*a*) It requires comprehension; (*b*) It is typical of all silent reading for technical-information purpose. Instruction sheets give the students a chance to regulate their speed in comprehension to suit their capacities. Industrial-arts teachers should recognize that students need training in reading habits.

13. Instruction sheets need not be uninteresting to the pupil. A neat, attractive-looking, well-illustrated paper is far more interesting than a long, plain, typewritten sheet. A little sugar-coating can be resorted to without making the work too easy for the pupil.

14. Unless the teacher activity decreases in direct proportion to the increased use of instruction sheets, there should be no danger of accidents in the shops. The danger lies in the substitution of instruction sheets for personal-teaching activities. Here, again, it is not the fault of the instruction sheets, but rather that of the teacher.

15. The contention that the instruction sheets relieve the teacher of his teaching activities and reduce him to the status of a clerk is false. If they make a clerk of the teacher, it is his fault. Although the teacher must devote considerable time to writing and revising the sheets, their value in lessening the nerve-racking strain of the old method makes it worth while. When they are used as they should be, instruction sheets free the teacher from many details which tend to reduce his efficiency under the old method.

When individual instruction sheets are properly written and properly used, they offer many advantages as a method of teaching. Some of the chief values derived from their use will be given. Ericson[7] presents the following which is a representative list of the values set forth by various authorities:

1. Instruction sheets are a means of offering a greater variety of work in the shop.
2. They save time for the teacher.
3. They save some time for the students that would otherwise be wasted in waiting for the attention of the instructor.
4. Interest of the students is maintained because they can proceed with the work without waiting for demonstrations and personal instruction.
5. They furnish printed directions to be followed. Success in a great number of occupations depends upon ability to understand and follow directions set forth in this way; consequently, the practice is of high importance.
6. Students are left to their own resources in carrying out the work.
7. Instruction sheets are of great value as an aid to the demonstration.
8. If standard instruction sheets are used, it is quite probable that they are better organized with reference to procedure and other material than would be the oral instructions of the teacher.
9. They assist the teacher who is not mechanically proficient in all phases of the work.

After analyzing the chief difficulties and objections to the use of instruction sheets, it is quite clear that their value depends on how they are constructed and used. Although they are a most valuable teaching device, they are not intended to supersede all other forms of instruction. They are to be used as an aid rather than as an end in themselves. Their value in teaching may well be compared with the value of a balloon tire to the riding comfort of a car. It would be as foolish to stop using all the proved methods of teaching and depend on instruction sheets alone as it would be to throw away the springs of the modern automobile and depend upon the balloon tires for riding comfort. Each helps to solve a problem, but neither is designed to do it alone.

[2]Phillips, E. C., "Job Sheets and Operation Sheets as Teaching Devices," *The Industrial Arts Magazine*, 14:321–325, 1925.
[3]Fryklund, V. C., "Factors Affecting the Use of Instruction Sheets," *Industrial Arts Magazine*, 16:241–243, July, 1927.
[4]Van Westrienen, H. J., "Preparation and Use of Lesson Sheets," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, 20:237–242, July, 1931.
[5]Fryklund, V. C., "Factors Affecting the Use of Instruction Sheets," *Industrial Arts Magazine*, 16:241, July, 1927.
[6]Fryklund, V. C., "Factors Affecting the Use of Instruction Sheets," *Industrial Arts Magazine*, 16:241, July, 1927.
[7]Ericson, E. E., *Teaching Problems in Industrial Arts*, pp. 67, 68. The Manual Arts Press, Peoria, Ill., 1930.

Can We Improve Our Instruction Sheets?

John B. Brennan

Radio Instructor,
Vocational High School,
Jamaica, New York City

A discussion of present-day standards with a suggestion for a newer reproduction method which widens the scope in the preparation of sheets.

From an inspection of the various types of instruction sheets which are offered to vocational and industrial-arts instructors as a guide in the preparation of their own sheets, the observation may be made that too often these sample sheets go to the extreme in the stereotyped form they follow; too much space is given to relatively unimportant items; they fail to stimulate pupil interest because of their drabness from a visual standpoint; their readability is destroyed to a large extent because of the attempt to segregate information under various classifications.

In industry, it is true, the job sheet almost exclusively is a matter of filling in needed specifications in a carefully ruled, classified, and subdivided sheet. But here we are dealing with the adult mind and where production is the immediate goal. The stimulus is the pay envelope, pride in workmanship, progress.

In education, the adolescent and pupil mind must needs be appealed to by devious ways. The pupil must be sold first on the need or advisability for doing a certain job, not the least of which is the reading of the instruction sheet in its entirety. It is questionable whether the present accepted form accomplishes this purpose.

There is one school of thought, as exemplified by present-day types of instruction sheets, which, in effect, says,

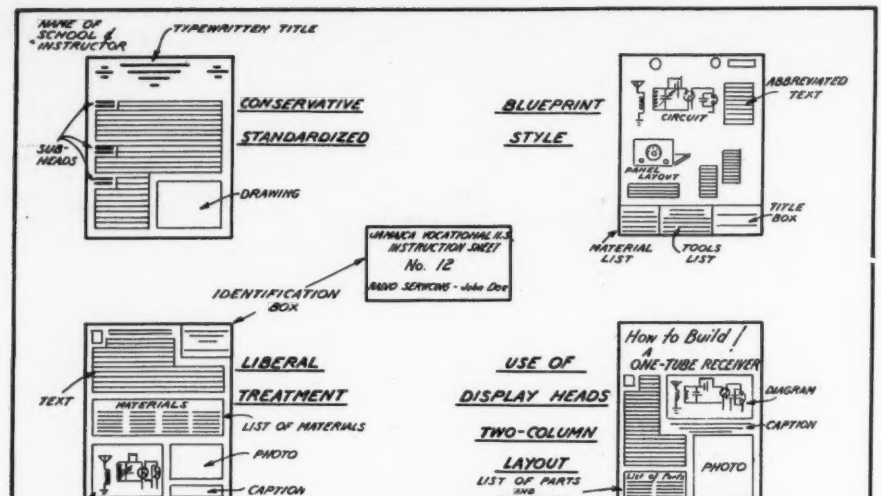


Fig. 1. Types of instruction sheets

"For the sake of uniformity, ease of use, and ease of preparation standardize and stereotype the form." Another school of thought, probably at present in the minority, but growing fast, adheres to the belief that "For the sake of variety, sustained interest and eye appeal, make the sheets of different forms and appearance."

In analyzing one of the so-called accepted forms of instruction sheet, the student, especially if he be given a folder full of instruction sheets, is first awed and then irritated by the monotonous repetition of the bold-face subheads such as: Objective; Tools; Material, Trade Mathematics; Trade Science, and the like.

In such a sheet, too, where an attempt is made to confine, if possible, the content to a single page, too much space is given to such relatively unimportant features of the sheet such as: Name of the school; course; kind of sheet; number or designation of sheet; instructor's name. Usually these items are given the same relative importance as the title of the sheet. Such a treatment curtails, to a marked degree, the space on the sheet which may be used for presenting the essentials of the job.

In support of the "variety" instruction-sheet idea, the reader is referred to the form of presentation employed in current quasi technical monthly magazines such as *Popular Science, Modern Mechanics, Scientific American, Aero Digest, Radio News, Radio Craft,* and others. It is true that, years ago, these magazines employed the stereotyped form of presentation in printing an article. But today, much use is made of the appeal afforded by the use of special faces of type, interesting photographs, requisite line cuts, intriguing page layouts, snappy, short titles, close association of parts and material lists with the diagrams they refer to, subheads and boxes (which afford a summarization of the article).

To catch the eye first, to arouse a curiosity by the spectacular spread is the stock-in-trade of the progressive layout man. Such present-day magazines in the "popular" field as *Cosmopolitan, The Saturday Evening Post, Pictorial Review,* and others, exemplify this trend to the extreme. There is much we can borrow in order to "sell" our sheets to the student.

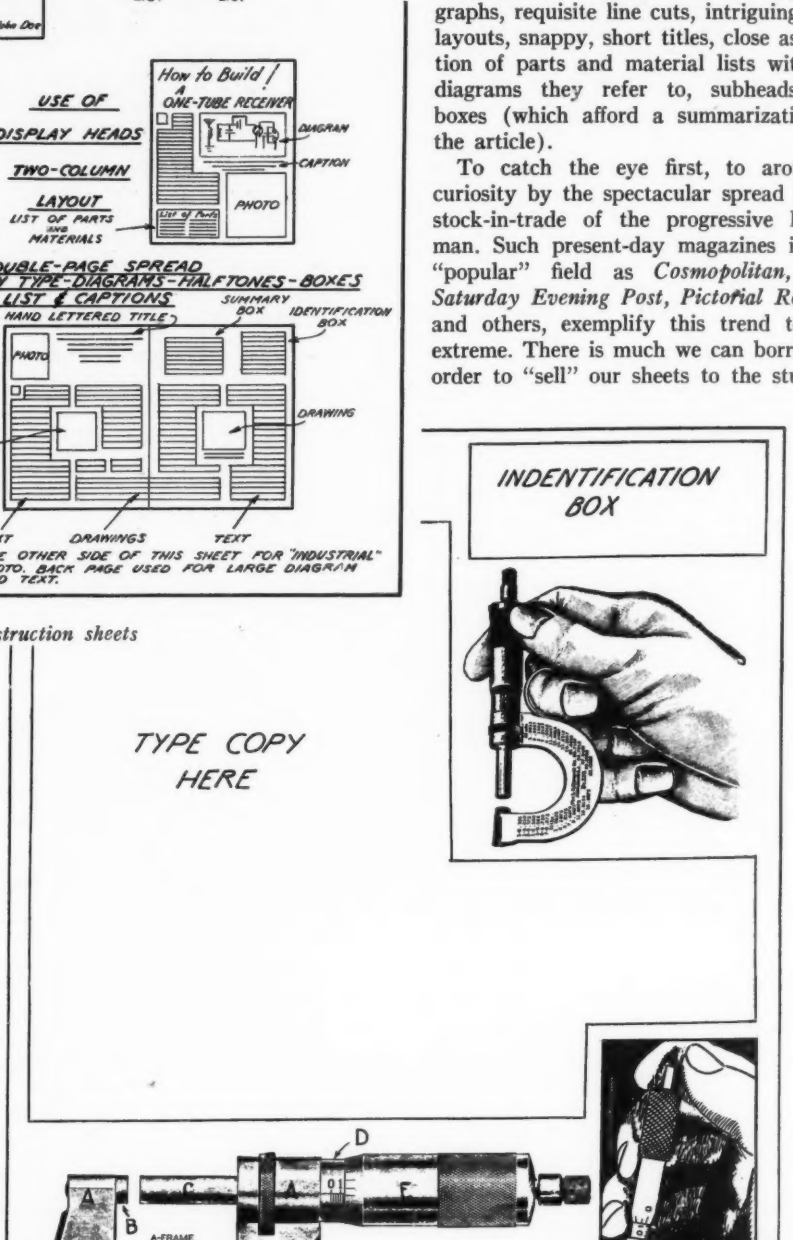


Fig. 2. How to read a micrometer caliper

From the viewpoint of surprise, arousing of curiosity as to what may come next, artistic presentation, directing student thought and attention to commercial applications, etc., there are arguments in favor of (1) issuing sheets one at a time rather than presenting the student with a folder of all the sheets comprising the course; (2) furnishing each sheet with a cover or frontispiece depicting some activity in industry to which the job may be tied. The folder idea could be retained, the student adding the sheets to the folder as they are issued to him by the instructor.

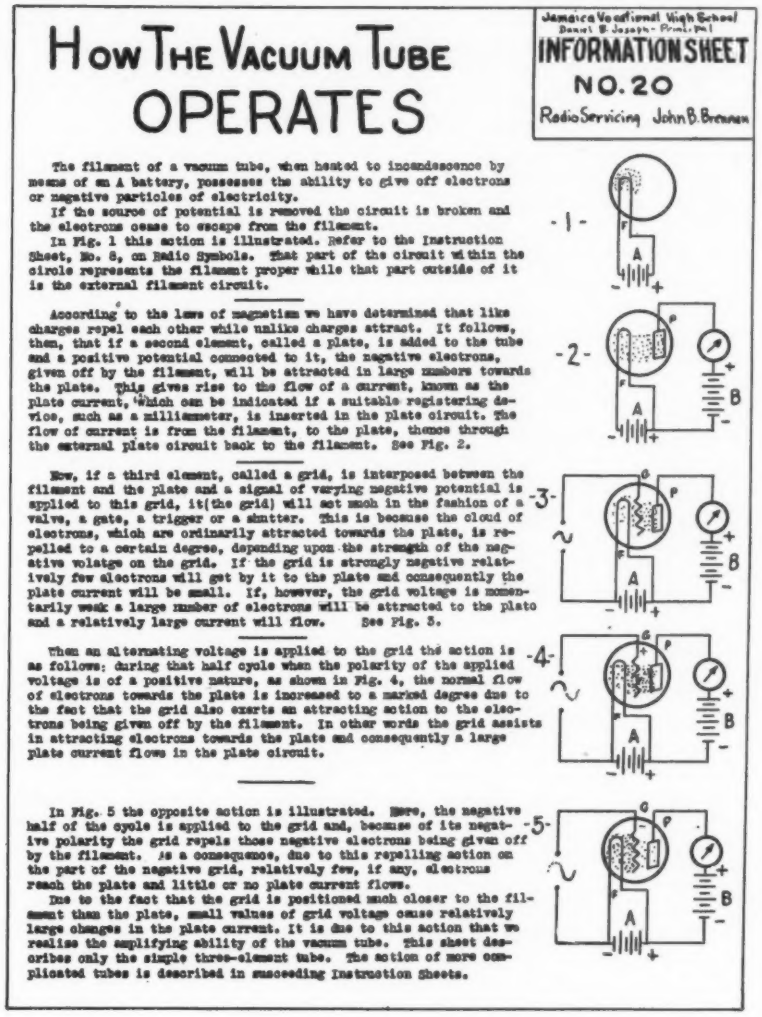
To furnish a basis for the comparison of the relative merits of both the systems discussed here, the page layouts shown in Figures 1 and 2, and the sample page, Figure 3, will be of interest.

In a majority of cases the instructor is governed in the matter of producing his instruction sheets, solely by the facilities at his disposal. If there be a fund for such work, or if it is permissible for him to dispose of the instruction sheets on a cost basis to the students, he may employ the offset printing process in the production of his sheets. The advantages accruing from the use of such a system cannot be overestimated. Line drawings and halftone illustrations are reproduced with equal facility. It is possible to mount the material to be reproduced on large sheets of cardboard and, in the printing process, reduce from the original to any desired size. Illustrations and drawings which appear in magazines may be cut out, mounted, and reproduced, if proper permission has been obtained from the publisher. The limitations which hold in the case of mimeographing are entirely eliminated.

Most important of all is the fact that the offset process of reproduction is by far more economical than any other reproduction system now available.

If the instructor is employed in a trade school, it is possible for him to enlist the co-operation of the printshop teacher and obtain from him proofs of type faces with which to dress up his sheets.

The progressive teacher can do much to make his sheets interesting and desirable. Probably limitation of reproduction facilities is the real reason for the stilted, stereotyped, conservative form of the majority of the present-day styles of instruction sheet.



Jamaica Vocational High School
Daniel E. Joseph - Principal

INFORMATION SHEET
NO. 20
Radio Servicing John B. Brennan

How The Vacuum Tube OPERATES

The filament of a vacuum tube, when heated to incandescence by means of an A battery, possesses the ability to give off electrons or negative particles of electricity.

If the source of potential is removed the circuit is broken and the electrons cease to escape from the filament.

In Fig. 1 this action is illustrated. Refer to the Instruction Sheet, No. 8, on Radio Symbols. That part of the circuit within the circle represents the filament proper while that part outside of it is the external filament circuit.

According to the laws of magnetism we have determined that like charges repel each other while unlike charges attract. It follows, then, that if a second element, called a plate, is added to the tube and a positive potential connected to it, the negative electrons, given off by the filament, will be attracted in large numbers towards the plate. This gives rise to the flow of a current, known as the plate current, which can be indicated if a suitable registering device, such as a milliammeter, is inserted in the plate circuit. The flow of current is from the filament, to the plate, thence through the external plate circuit back to the filament. See Fig. 2.

Now, if a third element, called a grid, is interposed between the filament and the plate and a signal of varying negative potential is applied to this grid, it(the grid) will act much in the fashion of a valve, a gate, a trigger or a shutter. This is because the cloud of electrons, which are ordinarily attracted towards the plate, is repelled to a certain degree, depending upon the strength of the negative voltage on the grid. If the grid is strongly negative relatively few electrons will get by it to the plate and consequently the plate current will be small. If, however, the grid voltage is momentarily weak a large number of electrons will be attracted to the plate and a relatively large current will flow. See Fig. 3.

When an alternating voltage is applied to the grid the action is as follows: during that half cycle when the polarity of the applied voltage is of a positive nature, as shown in Fig. 4, the normal flow of electrons towards the plate is increased to a marked degree due to the fact that the grid also exerts an attracting action to the electrons being given off by the filament. In other words the grid assists in attracting electrons towards the plate and consequently a large plate current flows in the plate circuit.

In Fig. 5 the opposite action is illustrated. Here, the negative half of the cycle is applied to the grid and, because of its negative polarity the grid repels those negative electrons being given off by the filament. As a consequence, due to this repelling action on the part of the negative grid, relatively few, if any, electrons reach the plate and little or no plate current flows.

Due to the fact that the grid is positioned much closer to the filament than the plate, small values of grid voltage cause relatively large changes in the plate current. It is due to this action that we realize the amplifying ability of the vacuum tube. This sheet describes only the simple three-element tube. The action of more complicated tubes is described in succeeding Instruction Sheets.

-1-
-2-
-3-
-4-
-5-

Fig. 3. An information sheet

Operating Sheet on the Variety Saw

C. A. Conley

Brewster Vocational School,
Tampa, Florida

An operation sheet of the question-and-answer type.

1. *Why is it necessary to get permission from the instructor before using the variety saw?*

It is necessary first to get permission from the instructor for the following reasons: (*a*) So he can assure himself whether the student is competent to operate the saw, and whether he knows how to perform the needed operation correctly.

2. *What is the use and purpose of the guard over the saw?*

The purpose of the guard over the saw is to protect the one who is using the machine against injury. It is to be kept over the saw at all times.

3. *When and how would you make adjustments of the saw or dado for clearance above the saw table?*

Make all adjustments of the saw or dado for clearance above the saw table before starting the motor.

4. *How much clearance should the saw have above the saw table for a given job, take for example the ripping of a piece of stock ⅞ in. thick?*

The saw should extend the thickness of the wood, plus ⅛ in. Thus, for ⅞-in. lumber, the saw should extend 1 in.

5. *What is the proper position for the operator to take while using the saw?*

The proper position for the operator is a little to the left or out of line of the saw, with both feet firmly on the floor.

6. *When should the motor be started?*

Start the motor after all adjustments are made, and after you have made sure that everything is out of the way, so that no one will be injured.

7. *Is loose clothing such as sleeves, ties, etc., dangerous to the operator of the variety saw? Give reasons.*

Loose clothing is dangerous because it is likely to get caught in the machine and cause an accident.

8. *Should you remove small pieces of stock or waste from near the saw while the machine is in motion? Give reason for your answer.*

You should never remove waste or small pieces of stock from near the saw, because you are likely to get cut or cause a small piece to be thrown by the saw which may hurt someone.

9. *Do you know which saw to use for each job, such as ripping, crosscutting, or dadoing? Explain your answer.*

You should use the rip saw for ripping, the crosscut saw for crosscutting, and the dado for cutting a rabbet or groove.

10. *In moving the ripping fence is it necessary to fasten it to the saw table again? State two reasons.*

In moving the ripping fence you must fasten it to the table for the following reasons: (*a*) Someone might start to use the saw and the fence not being fastened would slip and cause him to get cut. (*b*) Someone might knock it off onto the floor and break it.

11. *What would you do if the saw should bind in the cut as you were ripping a piece of stock? Why?*

If the saw binds in the cut as you are ripping a piece of stock, pull back to release the saw and shut off the switch and see what is the cause of the trouble. If the saw gets too hot, it will lose its temper.

12. *What is the ripping fence, and what is its use in connection with the variety saw?*

The ripping fence is a movable guide on the saw table. It guides the stock while using the ripsaw. Use the ripping fence for ripping. When using it for gauging lengths with the cut-off saw, a gauge block fastened to the ripping fence, may be used.

13. *What special device would you use in ripping short or narrow stock? Is there any danger in connection with this operation?*

In ripping short or narrow stock, a push stick should be used, otherwise the hands of the operator come too close to the saw and he may get cut.

14. *Explain what is meant by the term "push stick" in connection with the ripsaw.*

A push stick is a narrow piece of stock used to push the stock to be ripped by the saw.

15. *What does the term "ripping a piece of stock" mean? What saw would you use for this operation?*

The term "ripping a piece of stock" means cutting it with the grain. A ripsaw is used for this operation.

16. *In ripping a piece of stock at an angle, would you have any use for a jig? Explain the term "jig."*

Yes. A jig is a board cut at a given angle and is used against the ripping fence to enable you to cut another piece of stock the same angle as the angle on the jig. A separate jig must be made for every different angle.

17. *What is the cut-off fence, and what is it used for?*

The cut-off fence is a sliding gauge on the saw table. It can be set at any angle from a right angle to 45 deg. The stock is held against the cut-off fence while the crosscut saw is used.

18. *Would you use the cut-off fence in connection with the rip or crosscut saw?*

The cut-off fence should be used with the cut-off saw only.

19. *What is the gauge block? Explain its use in connection with the ripping fence.*

The gauge block is a piece of iron about 4 in. square, with a true surface on one side and a pin on the other side to fit a hole in the ripping fence. This block is used against the ripping fence with the pin in the hole to gauge the length of stock when more than one piece is to be cut the same length.

20. *What are the gauge stick and slide? Explain their use in connection with the cut-off fence.*

The gauge stick is a square piece of iron that fits into a groove cut in the cut-off fence. The slide fits over this stick and can be adjusted to cut more than one piece of stock the same length.

21. *How is the cut-off fence set to cut a given angle? Example: 45 deg.*

To cut a given angle, loosen the nut and set the cut-off fence, by the scale given on it, to 45 deg.

22. *Can the saw table be tilted to cut a given angle, say of 45 deg.? Explain this operation.*

Yes. Loosen the lock and turn the wheel until the arrow points to 45 deg. on the scale. Then lock the table in position.

23. *What is meant by the term "saw arbor"?*

Saw arbor is the projecting circular piece on which the variety saw is fastened.

24. *What kind of threads are found on the saw arbor in reference to right or left hand?*

Left hand.

25. *In mounting a saw on the arbor, which way should the teeth point with reference to the position of the operator?*

In mounting a saw on the arbor the teeth should point toward the operator.

26. *A dado head is composed of how many different kinds of cutters?*

A dado head is composed of outside and inside cutters.

27. *What cutters are required in cutting a 5/8-in. groove?*

In cutting a 5/8-in. groove, use the two outside cutters, as they are 1/8 in. thick, then two inside cutters, the one 1/4 in. thick and the other 1/8 in. thick, making 2 outside cutters and 2 inside cutters.

28. *Are there any special precautions about the position of the door enclosing the saw while the saw is in motion? Does this remain the same while the dado is on the arbor whether it is being used or not?*

The door enclosing the saw should be blocked part way open while the dado is on the arbor, whether the dado is in use or not, to keep the arbor from striking the door.

29. *While waiting for your turn on the machine, is there any special reason why you should not lean on the saw table or stand at either side of the machine while someone is operating it? Explain your answer.*

One should stand at the right side of the machine while it is in use so the operator will not be interfered with. One should never lean on the saw table, as this is likely to cause an accident.

30. *Should the operator talk while using the saw?*

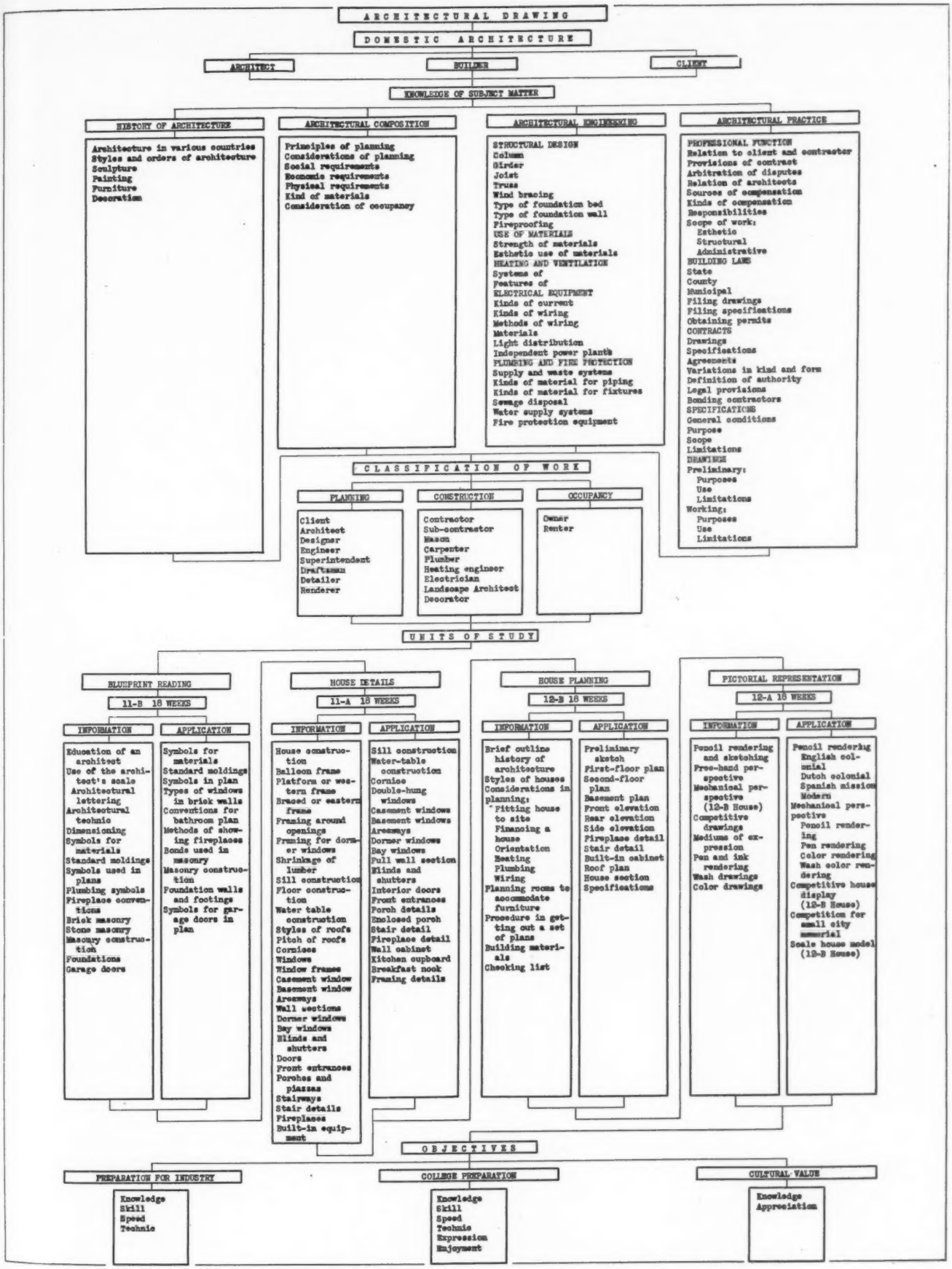
He should never talk while operating the machine as it takes his mind off his work and he is likely to get hurt. He must have his mind on the job continually.

31. *What will be the result if the operator fails to hold the job against the stops while cutting?*

He is likely to cause an accident or spoil the job.

INDUSTRIAL ARTS

Bonser (7, p. 50) says: "Industrial Arts as a school subject, is the distilled experience of man in his resolution of natural material to his needs for creature comfort, to the end that he may more richly live his spiritual life." Winslow and Gompf (45, p. 1) refer to it as "a culture study with the emphasis upon the how and why of industrial operations, combined with a real appreciation of industrial life." — *Terminological Investigation, Western Arts Association.*



Analysis of architectural drawing, Harvey W. Waffle, High School, Waukesha, Wisconsin

Building Trades in the Small High School

R. L. Ready

Batavia, Illinois

An outline that has served a need in a very practical manner.

There are certain boys in every high school who, for one reason or another, are not interested in the regular academic or college-preparatory courses. Some boys are not capable of doing satisfactory work in these courses, and others are not interested because they know they will not be able to go to college. These boys have a right to expect the high school to offer them some course that will help them get a job when they graduate. Most of the larger high schools offer some type of vocational or industrial-arts work for these boys, but many of the smaller high schools do not. In fact, many of the smaller high schools offer more practical work for girls than they do for boys.

In 1934, the school officials of Batavia decided to introduce some type of vocational work into the high-school curriculum that would meet the needs of these boys. The need for such work was very evident, but the question was "What type of work would be the most practical?" After a careful survey had been made, a course of vocational building trades was decided upon. There were several reasons for this decision. In the first place, it was found that with one exception, the building trades employ more men in Illinois than any other one occupation; the outlay for tools and equipment is small; adequate shop facilities were already available, and there was found to be a shortage of building-trades craftsmen in the community. It was decided to make the course conform to the Smith-Hughes requirements, so as to get federal and state aid.

The following two-year course of study, together with courses of study in related mathematics and science, were worked out and sent to the state department for approval. This was obtained, and in September, twenty boys enrolled in this class.

Course of Study for the Building Trades

Units for First-Year Shop Work

Unit I. Tools and Basic Tool Processes.
Unit II. Joinery and Cabinetmaking.
Unit III. Wood Finishing.
Unit IV. Sheet Metal.
Unit V. House Wiring.
Unit VI. Plumbing and Heating.
Unit VII. Cement and Masonry Construction.
Unit VIII. Drawing and Blueprint Reading.
Unit IX. Carpentry.

UNIT I. Tools and Basic Tool Processes

Objective: To know how to sharpen and use the tools commonly found in carpenters' and cabinetmakers' tool chests.

A. *Laying out tools*
   1. Rules and tape measure.
   2. Squares. Try, framing, bevel, and combination.
   3. Gauges. Kinds and uses.

B. *Saws*
   1. File and set rip and crosscut saws.
   2. Crosscut and rip hard- and softwood on saw horses and in vise.
   3. Backsaw using bench hook and vise.
   4. Use miter saw.
   5. Use coping, keyhole, and turning saws.

C. *Planes*
   1. Sharpen and adjust a jack plane. Plane face edge and end with jack plane.
   2. Surface planing. Warp and wind.
   3. Sharpen a jointer plane. Plane a glue point.
   4. Sharpen and use a block plane.
   5. Sharpen and use a match plane and combination plane. Plane groove, rabbet, and dadoes.

D. *Hammers*
   1. Proper way to drive and draw nails.

E. *Chisels*
   1. Sharpen and use. Chisel a mortise.
   2. Sharpen and use a gouge.
   3. Chisel with and across grain.

F. *Boring tools*
   1. Bit braces. Ratchet and common type.
   2. Auger bits. Kinds and sizes. Bore holes through hard- and softwood.
   3. Drill and gimlet bits.
   4. Countersink and screw-driver bits.
   5. Practice depth boring, using depth gauge. Make dowel joint. Bore for mortise.
   6. Yankee and other hand drills.

G. *Screw drivers*
   1. Sharpen a screw driver.
   2. Drive screws using hand, Yankee, and bit screw driver.

H. *Scrapers*
   1. Sharpen and use hand and cabinet scraper.

J. *Other tools:* Nail set, awl, spokeshave, drawknife, etc.
   1. The use of these tools will be taken up incidentally with the other tools.

UNIT II. Joinery and Cabinetmaking

Objectives: To know how and be able to correctly make the joints commonly used in cabinetmaking. To be able to lay out the work on a small piece of furniture, and to do all the necessary tool processes.

A. *Lay out and make:*
   1. A mortise-and-tenon joint.
   2. A doweled glue joint.
   3. Tongue-and-groove joint.
   4. End and half-lap joints.
   5. Cut and nail a miter joint.
   6. Metal-fastened butt joints.

B. *Lay out, cut to length, square up, and mark mortises in the legs for a desk.*
   1. Bore and chisel the mortises.

C. *Lay out, cut to length, and square up the rails for a desk.*
   1. Cut the tenons.

D. *Lay out and cut material for drawers.*
   1. Rabbet and plow drawer stock.
   2. Assemble drawers.

E. *Select and cut stock for top.*
   1. Joint edges and bore for dowels.
   2. Glue up top.
   3. Plane for warp and wind.

F. *Assemble rails and legs using hot glue.*

G. *Scrape and sand.*

H. *Scrape and sand top. Fasten top to table.*
   1. Methods of fastening top.

NOTE: This work to be done on desks for the drawing room and other school furniture.

UNIT III. Wood Finishing

Objectives: To know something about the different kinds of finishes, their ingredients and methods of manufacture, and also how to prepare and apply them.

A. *Preparation of the wood*
   1. Scraping, sanding, dusting, raising the grain, etc.
   2. Fillers for open grain. Their composition and application.

B. *Stains.* Kinds, manufacture, and application.
   1. Staining with oil, water, and spirit stains.

C. *Shellac.* Kinds, manufacture, and application.

D. *Varnishes.* Kinds, manufacture, and application.

E. *Paints.* Kinds, manufacture, and application.

F. *Lacquers.* Kinds, manufacture, and application.

NOTE: Literature from various paint and varnish companies will be used as reference material.

Also take up the study of the above in the related-mathematics class.

The various pieces made in Unit II will be finished. The interior of the shop will be painted.

UNIT IV. Sheet Metal

Objectives: To learn how to hang gutters and downspout. The correct way to use flashing. How to lay a tin deck. Something of the composition and manufacture of the kinds of metal used in building. How to tin and use a soldering copper.

A. *Gutters and downspout*
   1. Built in. Hung.

2. Materials used.
3. Sizes for roof.

B. *Flashing.* Where and why used.

C. *Metal roofs*
1. Materials used.
2. How applied.

D. *Tin a soldering iron*
1. Solder a lap joint.
2. Kinds of solder. Soldering fluxes.

NOTE: Take up more fully in science class.

UNIT V. Electricity and House Wiring

Objectives: To learn how to install the various kinds of wiring. The cost, advantages, disadvantages, etc., of each kind.

A. *Kinds of wiring.* Knob and tube, B. X. conduit, etc.

B. *Circuits, switches, outlets, etc.* Local building-code requirements.

C. *Splices:* Soldering. Tapes.

D. *Installation.*

For these installations use a garage that is not finished inside, or build up a wall section in the shop.

NOTE: Take up study of electricity in science class.

UNIT VI. Plumbing and Heating

Objectives: To know the different types of heating plants, something about their installation, how to cut and thread pipe, and how to install fixtures.

A. *Types of heating plants*
1. Study various types.
2. Installation.
3. Air conditioning.

B. *Plumbing, Fittings, Fixtures*
1. Cut and thread pipe.
2. Install a new toilet in the shop.
3. Install showers in the grade gymnasium.

C. *Local plumbing codes*

D. *Sewage disposal*

NOTE: Take up also in science class.

UNIT VII. Cement and Masonry Construction

Objectives: To know something of the manufacture of cement, its uses: mixes, how to build forms, mix, reinforce, and pour concrete. The kinds of brick, bonds, mortar, etc.

A. Make forms and mold cement bricks of various mixes. Test.

B. Build forms for and pour a section of a walk. Repair walks around school. Make cement floor for bicycle rack.

C. Excavate, build forms, and pour foundation (cold frame).

D. Brick bonds.
1. Lay up walls using the cement bricks made.
2. Brick veneers.

E. Flue liners, and fire brick.

F. Mortar and plaster.

G. Ashlar.

NOTE: Take up more fully in science class.

UNIT VIII. Drawing and Blueprint Reading

Objectives: To know how to draw a set of working plans, how to read and interpret plans and specifications, and how to work from plans.

A. *Architectural plan symbols*
1. Draw and apply.

B. *Architectural details*
1. Window.
2. Door.
3. Stair, cornice, etc.
4. Fireplace.
5. Trim, built-in fixtures, etc.

C. *Plans*
1. Room arrangements.
2. Dimensioning.
3. Scales.

D. *Elevations*
1. Openings.
2. Dimensions, etc.

E. *Sections*

F. *Specifications*

NOTE: All drawings in pencil. Bills of material and specifications worked out in mathematics class.

UNIT IX. Carpentry

Objectives: To know how and be able to do the common jobs of carpentry.

A. *Sills*
1. Kinds. Make in shop.

B. *Stud framing*
1. Frame the studs, with openings, for a garage.

C. *Rafters and roofs*
1. Kinds of rafters. Lay out and cut each.
2. Roofing materials.

D. *Cornices*
1. Box and open.

E. *Sheathing*
1. Roof and side wall. Materials used. Diagonal and straight.
2. Put sheating on walls and roof of playhouse.

F. *Insulating materials*
1. Kinds (get samples).
2. Advantages of, cost, etc.

G. *Flooring*
1. Kinds, sizes.
2. How laid.
3. Lay floor in playhouse.

H. *Stair framing*
1. Types, proportions, rise, run, etc.
2. Build stairs to scale.

J. *Framing openings*
1. Window and door sizes, headers and trimmers.
2. Trussing.

K. *Interior*
1. Lath and plaster, metal lath, plaster bases, grounds.
2. Paneling.
3. Trim.

L. *Exterior*
1. Kinds of exterior finish.
2. How applied.

NOTE: Frame roof for a full-size 24 by 24-ft. garage. Build stairs, windows, etc., to scale. Build a garage 10 by 20 ft. and finish it so it can be used as a child's playhouse. (These projects are to be sold when finished.)

Second Year. Construction Work

Objectives: To put into practice, in a workmanlike manner, on an actual construction job, the things learned in the first-year course.

A. Draw plans, work up specifications and bills of material for the job to be done.

B. Organize for work, select foremen, timekeeper, tool checker, etc.

C. Do the work in the most efficient and workmanlike manner.

NOTE: Keep the science and mathematics related to the work as it progresses.

The class was divided into four groups, each group electing one of its members as foreman. These foremen met with me before class each day, at which time the day's work for the various groups was outlined. Each foreman was held responsible for the work of his group, as well as for the tools and equipment used.

We were able to find some work at the different schools, in connection with every unit outlined. In the furniture and cabinet-making unit, twenty drafting tables were made, besides various other pieces of school furniture; in the cement unit, walks were repaired and a 500-sq.-ft. platform for bicycle racks was made; various plumbing, wiring, and painting jobs were done; in the carpentry unit, each group framed either a garage or a cottage to the scale of 2 in. equals 1 ft. One group built a garage half size and sold it for a child's playhouse. Each student cut rafters, stair stringers, etc., either full size or to scale.

The local craftsmen were always ready and willing to come to the shop, and give talks or demonstrations of their particular phase of the building trades. There is an unlimited supply of material that is valuable as supplementary or reference material which can be obtained from different manufacturers at little or no cost. This material was used both in the shop and in the science class.

We feel that the first year's work is very much worth while within itself. The senior boys who took this course gained much practical information even though they did not have the opportunity of doing the actual construction work which is outlined for the second year.

When we started to line up a house job for the second-year boys for this school year, the question naturally arose as to what would be the attitude of the local trade unions and craftsmen who had been out of work so long. Accordingly, a form letter was sent to twenty representative craftsmen and contractors of the community.

The replies to this letter were very gratifying. In every case the answer was favorable, and in most cases, the individual or firm answering offered hearty co-operation in making the work successful.

We had the choice of building a small house for a private citizen or a Boy Scout cabin. We chose the cabin because of its location near the school. It is of frame construction, 24 by 36 ft., with a large stone fireplace and a stone porch. The

Batavia Post No. 504 of the American Legion furnished the site and is paying for the material.

At the holiday vacation, the second-year class had practically all the outside work done on the cabin. Rainy days or days too cold to work outside, the boys have spent in the shop listening to talks by local craftsmen, making and painting frames for the cabin, making a miniature wiring layout for the cabin (using flashlight bulbs), studying new methods and materials in building, heating, and air conditioning.

The boys on this job have had the practical experience of planning and figuring the cost of the building, excavating, forming, mixing and pouring concrete, all the carpentry work, the masonry work on the porch and fireplace, wiring, painting, plumbing, the interior trim, building seats, bookcases and trophy cases, in fact, all the most common phases of the building trades. Thus besides bringing the school and community into closer relationship, the boys have gained practical and worthwhile training.

General Metal Course for High School

W. H. Bowers

High School,
Tuckahoe, New York

This course was arranged for the tenth, eleventh, and twelfth grades in the Tuckahoe High School, New York, as a general metal course; it contains enough material for one year's work, five double periods per week.

This is the only high school in this vicinity. About 500 pupils attend from grades one to twelve. It is a residential section, yet 80 per cent of the pupils are from the village of Tuckahoe, mostly of the working class. There are no manufacturing industries here.

"General Shop" is pursued in the seventh, eighth, and ninth grades, and unit courses are offered to high-school boys in cabinetmaking and general metalwork. Mechanical drawing is also taught to high-school boys. The shop is equipped as follows: Band and circular saws, jointer, wood and metal lathes, glue and paint benches (3 sections), four double woodwork benches, drill press, gas furnace, anvil, stake bench, metalwork and two small machinist's benches, and one sheet-metal machine. All the necessary small tools and equipment are available for both wood- and metalwork.

Processes and Operations

Marking Metals — Straight lines, curved lines, transferring patterns to metal, free-hand layouts.

Cutting — Staight lines, circular forms, irregular forms.

Folding — Single and double hems, wire edges.

Wiring — Flat forms, conical forms, cylindrical forms.

Riveting — Flat pieces, band iron.

Notching — Notching for wiring, notching for band iron, notching for hinges, notching for locks.

Grooving — Seams on flat metals, seams on cylindrical forms.

Turning — Edges on cylinders, edges for conical forms.

Burring — Turning burrs on disks, turning burrs on bottom edges, turning burrs on covers.

Locking — Turning single locks, turning double locks.

Bending — Band iron, angle iron.

Beading — Single and double beads.

Crimping — Cylindrical and conical forms.

Setting Down — Edging for seams, locks.

Raising — Disks, irregular forms.

Sawing — Jeweler's saw, hack saw.

Hand Polishing and Buffing — Copper, brass, pewter, nickel silver, aluminum, garalloy.

Peening — Band iron, copper, brass, pewter, nickel silver, aluminum, garalloy.

Planishing, Embossing, Chasing, Etching, Soldering — Flat and riveted seams, soldering bottoms, sweating and tinning.

Lathe Work — Polishing, drilling, boring, straight turning, taper turning, knurling, cutting threads.

Using Gas Furnace — Heating metal, heating soldering coppers, forging metal, annealing metal, hardening metal, tempering metal, melting metal.

Using Grinder and Buffer — Grinding hand tools, grinding band and angle iron, polishing metals.

Drilling Holes with Drill Press — Holes on flat table, holes with work held in vise or jig.

Finishing — Painting (band iron), lacquering, waxing, enameling (copper and bronze), bronzing powders, metal polishes.

Tools to Be Used and Things the Pupils Are to Do with Them

Calipers — to measure distances.

Micrometer — to measure outside diameters.

Combination square and center head — to square work and locate center on round pieces.

Jeweler's saws — to cut irregular lines on copper, brass, pewter, silver.

Combination drill and countersink — to drill pieces for lathe.

Art-metal hammers — to planish, shape and raise metal.

Hack saw — to cut metal.

Rotary machine — to burr, turn, wire, crimp.

Stillson wrench — to turn and hold pipe.

Ladle — to melt metal.

Wire brush — to clean files.

Pipe cutter — to cut pipe.

Die — to cut threads.

File — to file flat and curved surfaces.

Blacksmith tongs — to hold metal while heating.

Socket wrenches — to remove bolts and nuts.

Open-end wrenches — to remove bolts and nuts.

The course outlined in this article covers the various phases of industrial-arts work in metal on the senior-high-school level.

Wooden and leather mallets — to raise soft metals without marking them.

Jig — to bend band iron into irregular shapes, for drilling, etc.

Materials — Aluminum, brass, copper, nickel silver, pewter, garalloy, galvanized iron, tin, band iron, angle iron, steel.

Emery cloth — to remove scratches, clean surfaces, polish surfaces.

Steel wool — to clean and polish.

Nitric acid — to etch and clean metals.

White metal — to cast.

Lead — to cast.

Borax — to use as flux.

Copper, brass, and galvanized-iron wire — to be used when needed.

Rivets, screws, and bolts — for fastening metals.

Hinges, hasps, catches, handles.

Solder — to join pieces together.

Sal ammoniac — to clean coppers.

Muriatic acid, rosin, and soldering paste — to be used as flux.

Zinc — to be used for making flux.

Lacquer and wax — to be used as a finish on art-metal objects.

Liver of sulphur — used for coloring copper.

Verdegris — used for coloring brass.

Bronze powders — used for finishing purposes (blown on).

Gasoline — for cleaning purposes.

Stones, clasps, ornaments — to be used on brooches, pendants, rings, earrings in jewelry work.

Machines

Lathe — straight and taper turning, thread cutting, facing, drilling, boring.

Grinder — to sharpen tools, to grind metals.

Bar folder — to bend metals.

Machine or machines — for burring, wiring, turning, beading, crimping.

Gas Furnace — to forge, anneal, harden, temper, melt and heat metal, heat soldering coppers.

Demonstrations

Demonstrations are not to occupy more than 10 to 20 minutes.

How to rivet, turn wire edges, use burring and setting-down machines, turn burrs on metal, turn locks on metal, fold hem, wire metal forms, notch, turn edges on metal, double-seam, tin copper, solder pewter, use borax, crimp, set down edges, raise copper and brass, raise pewter, use blowtorch, form ring on mandrel, determine size of ring, solder pin tongs on brooches, insert stones in rings and earrings, sweat two pieces together, harden and temper, use buffing wheel, chase metal, color metal, pierce metal, twist metal, use bending jig, cut thread on lathe, do cylindrical turning, do taper turning, do facing, do polishing, do drilling, set up chuck, knurl, anneal metal, read micrometers, do engraving, do embossing, distinguish cast iron, band iron, low carbon and high carbon steel.

Related Work

Safety: Danger of flying particles when pounding hot metal, safety precautions to be used when handling hot metal, safety when using machines, necessary precautions when using nitric acid, when using drill press.

Design: Laws of design as applied to forge work, how to draw simple geometric figures such as are needed in projects, need for careful designing in all metal projects, design in art-metal work, design as applied to jewelry.

Interpretation: Interpreting sheet-metal layouts, reading machinist's blueprints, block method of making scroll, cross-section views of machine parts, ability to read and understand instruction sheets.

Shop sketching: Sketch of project before starting a job; how to make a sketch of project from picture; laws of proportion, dominance, etc., in drawing project; layout of projects; sketch of funnel and cup.

Mathematics: Need for accuracy in measurements, how to figure h.p. of motors, how to use measuring devices, how to figure gears for cutting threads on lathe, how to figure cutting speeds.

Sociological aspects: Place of metal industries in community, advantages and disadvantages of unions, some labor laws in United States, effects of price cutting on employer and employee, effects of iron and steel on civilization.

History: Development of art metalwork, history of the automobile industry, history of iron and steel industry, development of common metalworking tools, development of lathe.

Occupational information: Opportunities in art-metal field; need for art training in art metal; nature of work in sheet-metal factories; effect of production work on industry and worker; opportunities in auto-servicing trades; the place of forging in industry; discussion of general field of metalwork; opportunities in sheet-metal trade; survey of jewelry trade, hours of labor, health conditions, hazards, wages, education requirements, etc., for the: Auto mechanic, machinist, sheet-metal worker, art metalworker, plumber, molder, jeweler.

Economics: The economic importance of the machine trades, the importance of iron and steel as a structural material, the value and cost of metal as compared with other materials for construction, comparative costs of different metals, how to choose the correct metal for the job.

Geography of transportation: Geographic location of the deposits of copper ore; effects of location of ore on centers of manufacture; geographic relation between deposits of iron ore, limestone, and coal, and effect on industrial growth; effect of ease of transportation of ore as a factor in location centers; geographic spread of metalworking and machine industries.

Science: Manufacture of sheet metal and tin plate, methods of applying zinc coating to iron; what happens when we tin a soldering iron; copper and action of cleaning agent; why tin burns off and how to prevent it; composition of solder and why it holds; science of refining iron and steel; manufacture of steel; physical structure of different metals and effect on selection for different purposes; relation of heat to the expansion and contraction of metals; principles of heat treatment of steel; annealing process and what happens when we do it.

Selection, care, and use of products: How to select, use and care for copper, brass, iron, steel, nickel silver, pewter, garalloy, soldering coppers, acids for etching, jeweler's fittings.

Projects

Art Metal (pupils to make 8 projects): Book ends; scroll design; copper tray; copper bowl; fruit bowl, chased petals; letter holder; letter opener (3 pieces, brass, copper and silver); corner for blotter pad; silhouette lamp (ship); watch fob; book mark; chest corners; weather vane; crumb tray; candle shade; ash tray; porch lantern (2 designs).

Pewter (pupils to make 3 projects): 6-in. salad dish (embossed); large elliptical tray (chased border and design in center); 10-in. dinner plate (3 partitions), fruit dish, mint dish.

Jewelry (pupil to make 3 projects): Bracelet (pierced, brass, and nickel silver); brooch (pierced, initial design); ring (initial, etched, or stone); earrings (initial, etched or stone); pendant.

Sheet metal (pupil to make 8 projects): Scoop, foot scraper, continuous memo pad, lamp reflectors, book ends, mend leaking dish, model boat, funnel, canteen, airplane, mail box, oil pan for garage, sink strainer, lighting fixture, cabinet, table, cup.

Forging (pupil to make 5 projects): Poker, lamps, fernery, bench, taboret, chisel, punch, fireplace tools, hammer, scratch awl, scriber, knife, star drill, umbrella rack, coffee table.

Machine shop (pupil to make 5 projects): Trowel, sink scraper, kitchen stool, wrench, paperweight, tin snips, Christmas-tree stand, flag stand, luggage carrier, sled, fern stand, magazine rack, floor lamp with ash tray, hammer, screw driver.

Homework

Outside preparation, 5 hours per week, or done in school outside of regular time.

1. Draw 2 views and development of a funnel.
2. Draw 2 views and development of a cup, including development of the handle.
3. Draw a dustpan, all views.
4. Design and construct a wrought-iron bracket, suitable for holding up a shelf.
5. Make an iron taboret for a plant.
6. Make a magazine stand out of iron.
7. Put on strap hinges.
8. Attach a door latch.
9. Put on common and chain bolts.
10. Fasten curtain rods and fixtures.
11. Repair and wind up a shade.
12. Make a screen for cellar window.
13. Examine and pack a faucet.
14. Clean a trap.
15. Open a stopped drain pipe.
16. Repair a flush tank.
17. Repair and clean carpet sweeper.
18. Sharpen kitchen knives.
19. Tighten and repair belts on machines at home.
20. Clean and oil machines.
21. Clean and oil fishing rod.
22. Make minnow pail.
23. Make bait box.
24. Make tackle.
25. Overhaul and repair bicycle.
26. Repair camp chair.
27. Repair and solder pails and other home implements.
28. Cups.
29. Pans.
30. Boat keels.
31. Repair toys.
32. Repair tires.
33. Clean battery terminals.
34. Clean spark plugs.
35. Remove dents.
36. Clean gas line.
37. Protect car from freezing.
38. Prepare car for storage.
39. Oil and grease car.
40. Change oil.
41. Tighten all bolts and nuts.
42. Make basketball goals.
43. Sharpen tools.
44. Retemper and reshape tools.
45. Ash tray, own design.
46. Design and make own book ends.
47. Make fireplace set.
48. Fernery.
49. Paperweight.
50. Make sled.

51. Make sugar scoop.
52. Design and make lighting fixtures.
53. Design and make napkin rings.
54. Umbrella rack (iron).
55. Iron bench, wood top.
56. Brackets for flower box.
57. Garden seat.
58. Hanging iron plant holders.
59. Iron smoking stand.
60. Christmas-tree standard.
61. Luggage carrier (iron).
62. Steel hammer.
63. Steel screw driver.
64. Sink strainer.

Written Assignments (Homework)

1. History of the auto industry.
2. History of the iron and steel industries.
3. History of the lathe.
4. Source of copper, value, and its place in industry.
5. Development of metalwork.
6. History of steelworkers' Unions.
7. Opportunities of the sheet-metal worker of today.
8. Geographic spread of metalworking and machine industries.
9. The manufacture of sheet metal and tin plate.
10. The history of aluminum.
11. Hours, wages, working conditions, etc., of the auto mechanic.

List of Metal Tools and Machines

2 Riveting hammers
2 Setting hammers
12 Art-metal hammers
2 Rubber mallets
1 Leather mallet
2 Dividers
6 Center punches
6 Puck punches
1 Pipe wrench
1 Monkey wrench
6 Assorted open-end wrenches
6 Scribers
1 Steel square
1 Steel straightedge
1 Pair trammel points
1 Circumference rule
2 Straight snips
2 Circular snips
1 Hawkbill snips
1 Wire gauge
1 Micrometer
2 Side-cutting pliers
2 Round-nose pliers
1 Combination pliers
1 Cutting nipper
1 Hand groover
6 Chasing tools
1 Set needle files
1 Set tapping tools and die
1 Chuck wrench, lathe
1 Chuck wrench, drill press
1 Drift
1 Tool-post wrench lathe
1 Armstrong pipe die
6 Rivet sets
3 Machinists' ball-peen hammers
1 Small rectangular stake
1 Small round stake
1 Mandrel, tapered
1 Bench plate
1 Mandrel stake
1 Blow-horn stake
1 Beak-horn stake
1 Candle-mold stake
1 Sliding T bevel
6 Half-round files
3 Round bastard files
3 Round smooth files
3 Triangular files
2 Square files
3 File cards
2 Plain rasps
4 Soldering coppers
6 Hollow punches
1 Hand drill
6 Jeweler's saws
2 Hack saws
1 Neck hammer
1 Set steel letters
1 Set steel numerals
1 Combination square
1 Surface gauge
2 Outside calipers
1 Inside caliper
6 Solid punches
2 Pairs goggles
1 Wire brush
1 Steel measuring tape
12 Assorted cold chisels
12 Screw drivers
1 Tap and die set
1 Reamer
1 Plumb and level
1 Set blacksmith's tongs
1 Drill press
1 Burring, turning, wiring, and setting-down machine, complete with rolls
1 Engine lathe
1 Gas furnace
1 Anvil
1 Bending jig

Reference Books

Art Metal Work with Inexpensive Equipment, Payne, Manual Arts Press, Peoria, Ill.

Big Book for Boys Hobbies, Hall, Lothrop, Lee and Shepard, New York City.

Job Sheets in Home Mechanics, Tustison, Bruce Publishing Co., Milwaukee, Wis.

Job Sheets for the Practical Electrical Shop, Tustison, Bruce Publishing Co., Milwaukee, Wis.

Model Airplane — How to Build and Fly Them, Allen, F. A. Stokes Co., New York City.

Model Boat Building for Boys, Cavileer, Bruce Publishing Co., Milwaukee, Wis.

Modern Radio Hook-Ups, Washburner.

Mechanical Drawing for High Schools, French and Svensen, McGraw-Hill Book Co., New York City.

Pewter Design and Construction, Varnum, Bruce Publishing Co., Milwaukee, Wis.

Plain and Ornamental Forge Work, Schwarzkopf, John Wiley & Sons, New York City.

The Boy Mechanic, Vols. I, II, III, and IV, Popular Mechanics Magazine, Chicago, Ill.

Sheet Metal Work, Frew and Bird, Manual Arts Press, Peoria, Ill.

Tin Can Projects, Hamilton, Dodd, Mead & Co., New York City.

Sheet Metal Workers Manual, Broemel, F. J. Drake Co., Chicago, Ill.

Volume N and R, Wrought Iron Designers, New York City.

Metal Work and Etching, Adams, Popular Mechanics Magazine, Chicago, Ill.

Essentials in Metal Working, Berg and Wing, Manual Arts Press, Peoria, Ill.

Elementary Wrought Iron, Bollinger, Bruce Publishing Co., Milwaukee, Wis.

Metal Craft and Jewelry, Kronquist, Manual Arts Press, Peoria, Ill.

How to Run a Lathe, South Bend Lathe Co., South Bend, Ind.

Trade Foundations, Carver, Manual Arts Press, Peoria, Ill.

Instruction Sheets, Pewter, E. W. Manzer, Bronxville, N. Y.

Jewelry Work (Instruction Sheets), Veiler.

SHOP MANAGEMENT

That Tool Problem Again

L. A. Hill

State Teachers College Training School, Memphis, Tennessee

A good discussion on the relative merits of the toolroom and the open tool panel.

The time taken for routine duties by a class in industrial arts is in part a measure of the efficiency of that class. In the industrial-arts laboratory, where there are numerous routine duties, it behooves the instructor to plan carefully the execution of such duties. Proper planning will bring the loss of time, patience, and energy to a minimum. An orderly, well-executed laboratory will improve the interest and attitude of the class.

If industrial-arts instructors are to teach habits of thrift, efficiency, thoroughness, neatness, and procedure planning in the laboratory: they must first set their own

house in order. They cannot have time for individual instruction and personal contact with each student without an efficient organization. They must plan for the following routine work that is common to most classes: (1) issuing of supplies and materials, (2) keeping a record of the materials and supplies used by each student, (3) checking the roll, (4) keeping a record of each student's progress, (5) storing the student's work from day to day, and (6) caring for the tools.

To care for tools, instructors have devised or copied from industry many systems. These systems can be classified into two groups: those using an open rack or panel from which the students secure the tools needed, and those using a toolroom from which tools are issued by a tool clerk to the students. In these systems all the tools may be kept at the place of storage, or the tools at the place of storage may supplement the tool kits that are located at the benches.

Before discussing the various systems it is first necessary to establish the essentials of a good system. The following are suggested as the most important qualifications of a tool organization: (1) The tools must be easily accessible to save the student's time so that he can spend a maximum of each shop period in constructive work. The enthusiastic student will become impatient with any complex system that delays his progress. It is the nature of the adolescent boy to want to rush through to completion any project started. Also the student will not be so likely to use a chisel or try square for a screw driver if the screw driver can be quickly secured. (2) The teacher must have an accurate check to prevent the loss of tools. He certainly cannot think himself successful if he permits tools to be stolen. It is quite embarrassing if there are many tools that cannot be accounted for at the end of the school year.

In a study made by the writer to find the difference in the time the different tool systems require for the tool routine, 18 junior high schools were visited and 36 classes observed. In making this study the writer also was interested in finding the effect the arrangement of the laboratory had on the time taken, and in finding the effect tool kits had on the time taken to secure and return tools.

In the laboratories not saving tool kits at the benches, that is, having all the tools at a central place of tool storage, the students averaged 3.7 trips per period to the place of tool storage to secure or return tools. It was found that in the laboratories having part of the tools in kits at the benches supplemented by tools from a tool panel or toolroom, the students made an average of 2 trips per period to secure or return tools. These data show that tool kits at the benches save 1.7 trips per student per period (see Fig. 1).

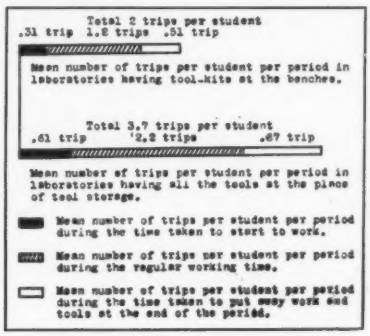

Total 2 trips per student
.31 trip 1.2 trips .51 trip
Mean number of trips per student per period in laboratories having tool-kits at the benches.
Total 3.7 trips per student
.61 trip 2.2 trips .87 trip
Mean number of trips per student per period in laboratories having all the tools at the place of tool storage.
Mean number of trips per student per period during the time taken to start to work.
Mean number of trips per student per period during the regular working time.
Mean number of trips per student per period during the time taken to put away work and tools at the end of the period.

Fig. 1. Number of trips made to place of tool storage

For the trips that were made to secure or return tools in laboratories using tool panels the average time per trip was 14 seconds. In laboratories using a toolroom the average time per trip was 34.8 seconds. The trips made to the tool panels averaged 20 seconds per trip less than those made to toolrooms. Figure 2 shows a comparison of the total times per trip, the amount of time per trip spent in walking, and the amount of time spent at the place of tool storage per trip.

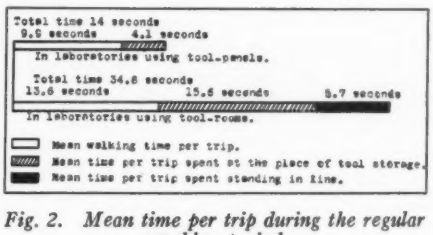

Total time 14 seconds
9.9 seconds 4.1 seconds
In laboratories using tool-panels.
Total time 34.8 seconds
13.6 seconds 15.6 seconds 5.7 seconds
In laboratories using tool-rooms.
Mean walking time per trip.
Mean time per trip spent at the place of tool storage.
Mean time per trip spent standing in line.

Fig. 2. Mean time per trip during the regular working period

The student spent more time per trip at the toolroom than was required for the entire trip to the tool panel. The time spent in walking to and from the toolroom was .4 second less than the total time per trip made to the tool panel. The tool panel was found to be located closer to the benches than the toolroom as is shown in Figure 3.

The importance of the time spent in walking is shown by the fact that in making trips to the tool panel the students spent 71 per cent of the time walking. This fact emphasizes the need of proper laboratory arrangement. As the time per trip was much greater in laboratories using a toolroom the time per trip spent in walking was 39 per cent of the total time per trip. The average distance walked per trip is shown in Figure 3. The figure also shows that three properly located tool panels are effective in reducing the walking distance.

A comparison of the total time per period taken for the tool routine during the actual working times is shown in Figure 4. By the actual working time is meant the time when all students have their work and tools out until the time the students are told to stop work and clean up at the end of the period.

In the laboratories using the tool panels the time taken to get out work and tools was one minute less than in the laboratories using toolrooms. It was also found that in laboratories using the tool panel, the classes took one minute less to return tools and put away work than was taken in the laboratories using toolrooms.

From the study it was concluded that the most efficient system was the one with tool kits at the benches supplemented with tools from two or more properly located tool panels. The study also brought out the importance of two or more tool panels to

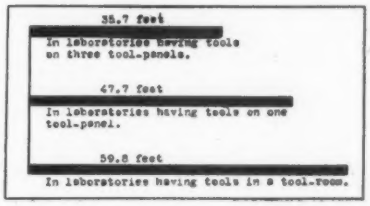

35.7 feet
In laboratories having tools on three tool-panels.
47.7 feet
In laboratories having tools on one tool-panel.
59.8 feet
In laboratories having tools in a tool-room.

Fig. 3. Mean distance walked per trip

reduce the walking distance and therefore the walking time. In the general shop with areas for each unit of work a tool system with a panel for each area is a good arrangement. The second most efficient system was the one with all tools on three or more tool panels. In many cases it might be the most practical as it requires a smaller investment in tools than to equip each bench with a kit of tools.

Although tool kits at the benches are effective in reducing the time taken for tool care, tool kits at the benches add to

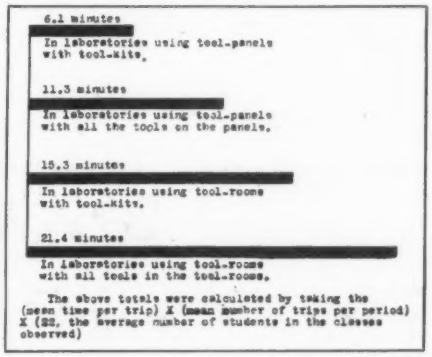

6.1 minutes
In laboratories using tool-panels with tool-kits.
11.3 minutes
In laboratories using tool-panels with all the tools on the panels.
15.3 minutes
In laboratories using tool-rooms with tool-kits.
21.4 minutes
In laboratories using tool-rooms with all tools in the tool-rooms.
The above totals were calculated by taking the (mean time per trip) X (mean number of trips per period) X (22, the average number of students in the classes observed)

Fig. 4.—Total amount of time taken during the regular working time

the problem of making an accurate check of the tools at the end of the period. This check for missing tools in the kits is most generally made by the student using the kit. The student is held responsible for checking the kit at the beginning of the

period and also at the end of the period. Many of the instructors using this system feel that it is satisfactory. The checking can be made more accurate and consistent if two or three students are assigned to check on the kits to verify the check made by the student using the tools. The importance of an accurate check will be emphasized later.

It was evident to the observer that the trips made to secure bits required the most time. The student would select a bit from the rack and look at the number to determine its size, and in most cases the student examined two or more bits before he found one of correct size. The reason for the confusion and delay in selecting the bits was the lack of system in placing the bits in the rack. All the bits were haphazardly placed in the rack, regardless of kind or size.

The following system is suggested to prevent this loss of time: (1) place the gimlet bits in one rack, the drill bits in another rack, and the auger bits in still another; (2) arrange the bits in order according to their size; (3) number the places in the rack to correspond with the size of the bit. Having separate places for the various kinds of bits will prevent their becoming mixed. The numbers on the rack will encourage the student to return the bits to their proper places and will help them in selecting the bit of correct size.

The second listed essential of a good tool system is that it prevents the loss of tools. The tools that are lost or disappear are those borrowed for use outside the laboratory and are not returned, and those stolen by the students. Many believe, and it is perhaps true, that the loss of tools through either route depends more on the teacher and his attitude than upon the system used. Many a teacher encourages theft by his attitude. Boys will delight in pilfering tools from a teacher to hear him fume.

Many of the users of the toolroom system claim that it will best prevent the loss of tools. These teachers feel that by issuing tools by some form of check, tools will not disappear so often. The brass number check is the most common form of tool check. Where the brass number check is used the tool clerk can check for missing tools by the checks left on the tool racks in the toolroom. The clerk's duty is to report such checks to the teacher. A search is then started for the missing tool. If the tool is not found the student checking out the tool is charged for it. The general rule is that this student must pay for or replace the lost tool.

If the tool clerk is absolutely accurate and above mistakes in checking out tools, we could be sure with this system that the user, but not necessarily the student stealing the lost tool, would be the one that must pay for it. If the student tool clerk always reported missing tools to the instructor, tools could not get out without the instructor knowing when they left. The teacher must occasionally check the toolroom for missing tools to keep the tool clerk alert, and, too, the tool clerk sometimes fails to put up a check when a tool is given to a student. If the teacher does not verify the tool clerk's report tools will be missing and the teacher will not know it. Although the succeeding tool clerk is supposed to carefully check for missing tools, he does not always do it. In the rush to get to the next class many times the check is taken from the tool rack and the fact that a tool is missing escapes the teacher's attention.

On the surface the number check would seem to work perfectly. But will the boy stealing a tool select one that he has checked out so that he will have to pay for it? There may be a few boys who would make such a mistake. It is more likely the boy pilfering a tool will select one that someone else has checked out. In this way, if the boy doesn't get caught, he has secured a free tool.

A missing tool is more likely to reappear if the cost of the missing tool is prorated among the members of the class. If every member of the class is charged for part of the cost of replacing the tool the boys will take it upon themselves to have the tool returned. They will find out who has the tool and see that it is returned, or that it reappears.

If the above statements are true the tool panel will prevent the loss of tools just as well as the greater time consuming toolroom system. The tool panel can be checked for missing tools by a student or the teacher just as easily and as accurately as the toolroom. The speed and accuracy of checking will depend upon whether or not the tools are well arranged in open view in the rack, and it makes no difference whether the rack is in a toolroom or whether it is an open tool panel.

As the toolroom must be checked for missing tools and not for brass number checks in the place of tools, the tool panel can be checked just as accurately by a student as the check made by the student tool clerk in the toolroom. If at the end of the period a tool is missing the instructor is just as likely to find out whether it is a tool panel or a toolroom that is used.

To prevent the loss of tools in any system it is necessary that the teacher know when the tool disappears, that the teacher keep an accurate record of the loss, and that the teacher prorate the cost of the lost tools among the members of the class in the laboratory at the time the tool disappeared.

To prevent tool borrowers from securing tools and not returning them is another problem. In some cases tools are not allowed to be taken from the laboratory. But too often the teacher must lend tools to clubs, other teachers, maintenance department, and others. To make sure that the teacher has a record of the tools that leave the laboratory the person borrowing the tools should be required to sign for them. Then if the tools are not returned the teacher has a definite record of where the tools should be and whom to hold responsible for them. If the tools are not returned by the end of the year the teacher can include this record in his annual report.

Where tool borrowers have access to the laboratory in the absence of the instructor, it is essential that the tools be locked. The toolroom does provide for such a lock. For the instructor that needs to lock the tools but otherwise prefers the tool panel, the tool cabinet is suggested. If properly constructed so that tools can be placed on the inside of the doors, the cabinet, when open, can be used just the same as the tool panel. The doors of the cabinet can be closed and locked so that those having access to the laboratory cannot borrow tools without the teacher knowing who has them.

Any system can be improved by immediately replacing lost or broken tools. The going and coming of tools make accurate checking difficult. It is not always possible to have a supply of tools so that the lost or broken tools can be replaced. If individual tool racks are used the empty rack can be removed when a tool is lost.

A complete inventory that is kept up-to-date should be posted near the tool panel. When in doubt as to the number of tools there should be on the panel the inventory makes the information accessible.

There are a few small tools in every laboratory that are most likely to be taken by the boys. The tools that can be carried away in the pockets are the ones that disappear most frequently. This shows that the boys do not take too great a chance. In some laboratories there are tools that are very expensive and are seldom used. Such tools can be kept in a special place where they may be locked up. But if small tools are kept on the panel with the other tools, and the instructor places special emphasis on checking them, the students will quickly take notice and be discouraged from pilfering them.

Most systems will bring the loss of tools to a minimum if the teacher stays

at his post and keeps the system working. If the teacher carefully explains the need of caring for tools; if each student understands the way the system is to be carried out; if the instructor makes sure that every boy does his part at the start, the natural enthusiasm of the first few weeks will carry the procedure until habit formation is started. As the enthusiasm begins to wane, the teacher must be alert to keep the procedure as set up. Every tool system depends on the instructor's keeping at his post. If the instructor takes the path of least resistance, the boys will do likewise.

An Industrial-Arts Procedure Sheet

Arthur Dunham

Woodward Avenue Junior High School, Kalamazoo, Michigan

A form of a procedure sheet which will improve with age.

The procedure sheet presented herewith, has been found extremely helpful. It is filed in an index box containing the cards grouped according to the subject being taught — one group for drawing classes, another for woodshop, another for woodturning classes, etc.

The idea of the sheet is to give the teacher a complete picture of the lesson to be presented. The items listed and their order may vary with different teachers. The blank space following *Tools and Materials* is for the listing of step-by-step procedure of the lesson and demonstration, and is purposely left blank because of the variety of steps in different lessons and the irregular space required for each step.

Not the least important heading is that of *References*. The teacher frequently reads magazine articles or books which contain exactly the material necessary for clarifying a certain point in classwork. Unless this information is jotted down, it will be forgotten. For this reason, this feature of the card is unusually valuable, and it gets to be increasingly important as time goes on and references are added and changed.

When the cards were first devised, they were made out in advance; then, after each succeeding lesson, it has been only a matter of a very few minutes to make desired changes. In the process of repeating the same course two or three times and making desired changes and additions to the references, the cards will become an invaluable aid, save time, and keep the lesson within concise and definite bounds.

INDUSTRIAL-ARTS PROCEDURE SHEET

Topic_____ No.____

Review and Correlation _____

Aim: _____

What to know: _____

What to do: _____

Tools and Materials: _____ Vocabulary:

Summary:

References:

Procedure sheet. Original 8 by 10 in.

Progressive Grading for Shops

K. W. Archibald

National City, California

Recording and preserving shop grades is an important part of the instructor's job. The method described here may solve the problem for many.

The system of grading which is outlined in this article is the result of several years of work and careful observation of pupil reactions under varying shop conditions. The author found himself in a position which seemed to call for some sort of system which would work quickly, yet be efficient enough to prove of benefit to both pupil and teacher. The resultant method of grading work fulfills these requirements, and the writer feels that it may be of interest to others as well.

By placing the grade given any pupil on an extremely objective basis, the new system protects the teacher from any charge of partiality. Such a method also makes his records clearer, more easily interpreted, and much more valuable, because they are of a more continuous nature than was possible under former methods.

By making it incumbent upon a pupil to cover new material in order to advance his class standing, and by making a record of this activity continuously available to him over the entire training period, the system benefits the pupil greatly.

While this method of grading has been adapted particularly to general metal and woodwork shops, it also can be applied to other types of work. It involves, first of all, a careful analysis of the subject to determine just what operations may be

considered basic, and should, therefore, be placed upon the master chart which is the nucleus of the entire plan. (See Figure 1.) Around this chart is built the structure of the course. One can go as far as desired with the matter of job and information sheets to be used in connection with the basic analysis. The number of projects that may be included as relating to the basic material, is practically limitless. The pupil, therefore, may have a wide range of choice in selecting his work material. This fact tends to make the system popular with the pupils, also.

In placing the system in operation, the chart shown in Figure 1 was prepared, and each basic operation was given a serial number. Cards were printed, each one bearing a set of numbers which correspond to those appearing with the basic operations on the master chart (Fig. 2). A list of projects was prepared to give the pupils a fairly wide range of choice, yet confine them to jobs which would yield the greatest amount of basic information per job. This factor is especially valuable because of the fact that time is somewhat short in the lower-grade work, and it is of advantage to have each job as rich in basic material as possible, so that the learning value may be high.

Figure 3 shows how stencils may be

BASIC OPERATIONS
(Using the tools listed)

1	Ruler	21		41		61	
2	Square	22		42		62	
3	Dividers	23		43		63	
4	Hacksaw	24		44		64	
5	Files	25		45		65	
6	Center punch	26		46		66	
7	Hammers	27		47		67	
8	Cold chisel	28		48		68	
9	Vise	29		49		69	
10	Screw driver	30		50		70	
11	Snips	31		51		71	
12	Anvil	32		52		72	
13	Tongs	33		53		73	
14	Hand drill	34		54		74	
15	Wrenches	35		55		75	
16	Etc.	36		56		76	
17		37		57		77	
18		38		58		78	
19		39		59		79	
20		40		60		80	

Fig. 1. Basic operations (using the tools listed) chart

Fig. 2

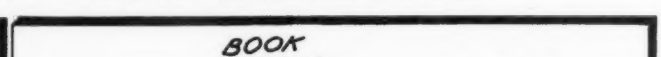


Fig. 3

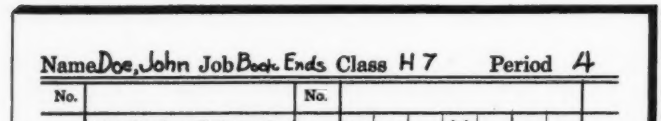

Name Doe, John Job Book Ends Class H 7 Period 4
No.
NAMES OF BASIC OPERATIONS ARE PLACED HERE.
OPERATION NUMBERS ARE CHECKED HERE THROUGH STENCIL
JOB CARD
Do Not Write In This Space

Fig. 4

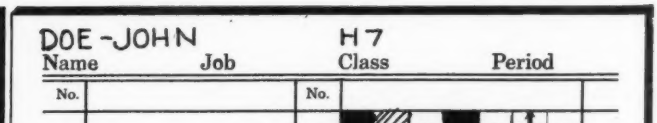


Fig. 5

made out of the printed cards by punching out the numbers which indicate the basic operations involved in a given job. Three files of alphabetized cards were kept. These files may be of the form shown in Figure 7. One file shows which jobs are in process, one shows which jobs have been completed, and one is a personnel file, showing each pupil's progress, and carrying his complete record of work for the time which he has spent on a subject. Since the student's record is continuous, he may return to the same shop for further instruction at any time. His previous record will then give the instructor information on what was previously accomplished by the pupil.

Inasmuch as credit is allowed under this system only on the basis of the number of basic units covered, no credit is given for the repetition of a unit. For instance, once a pupil has demonstrated his ability to use a cold chisel, he is given credit for it, and receives no further points for that operation although he may have to use it many times during the course of his work later on. For this reason, a pupil must take up new operations in order to advance his standing.

Perhaps the easiest way to clarify the operation of the system, is to follow through a typical case and trace the steps of activity concerned from the time that the pupil selects his job until the time that the job has been checked, and the record of progress made.

The pupil is first given a job card upon which are printed numbers that correspond to the numbers of basic operations as they are found on the master chart. (See Fig. 1.) He selects a job from the list of approved projects and fills in the heading of the card. This card is then placed behind the proper stencil and the key numbers to basic operations are checked through the holes in the stencil card. Figure 4 shows such a card upon which this has been done. The pupil next takes his card to the master chart and looks up the names of the basic operations indicated by the checked numbers, filling them in on the job card in the spaces provided for that purpose. Going from the master chart to a rack of numbered instruction sheets, he selects those corresponding to the numbers of basic operations required by his job and reads up on the material contained therein. After having done this, the pupil returns his card to the instructor for filing under the heading of "Job Under Way." Upon completion of the project, the instructor takes from his files the pupil's personnel card, places it behind the proper stencil card and marks on it the operation numbers for that job. (See Fig. 5.) These stencils automatically provide that only operations which have not been covered previously will be added to the record, for previous ones have already been marked out. The pupil's job card is then transferred to a file headed "Jobs completed."

Just as soon as one job is complete, the pupil is given a new job card, instructed to select another job from the approved list, and the process repeats itself.

The selection of this next, and other succeeding jobs, is of vital importance if the pupil is to advance his class standing at a maximum rate. The pupil and instructor are both interested in preventing excessive "overlapping" of basic units on this and succeeding jobs. The stencil cards again come into use at this point, and serve as an automatic job-selection device, to prevent this undesirable "overlapping." They are kept in a convenient rack (Fig. 6) so that the pupil may secure his personnel card from the instructor, and, by placing it behind each of the stencil cards in turn, can determine just which jobs will net him the most advance in points

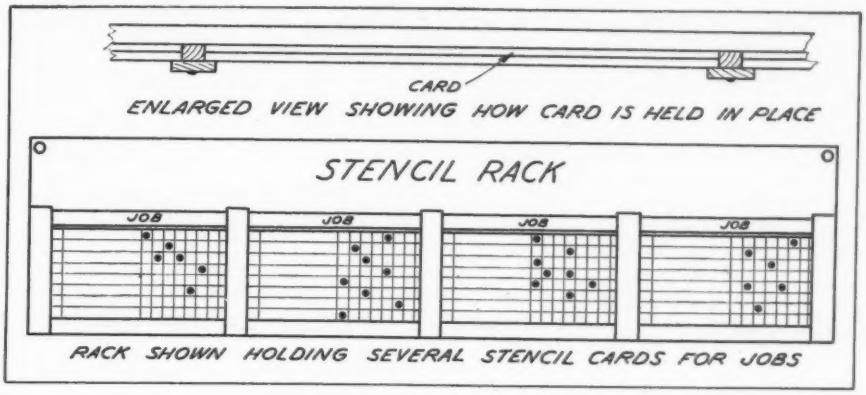


Fig. 6. Rack for holding stencils

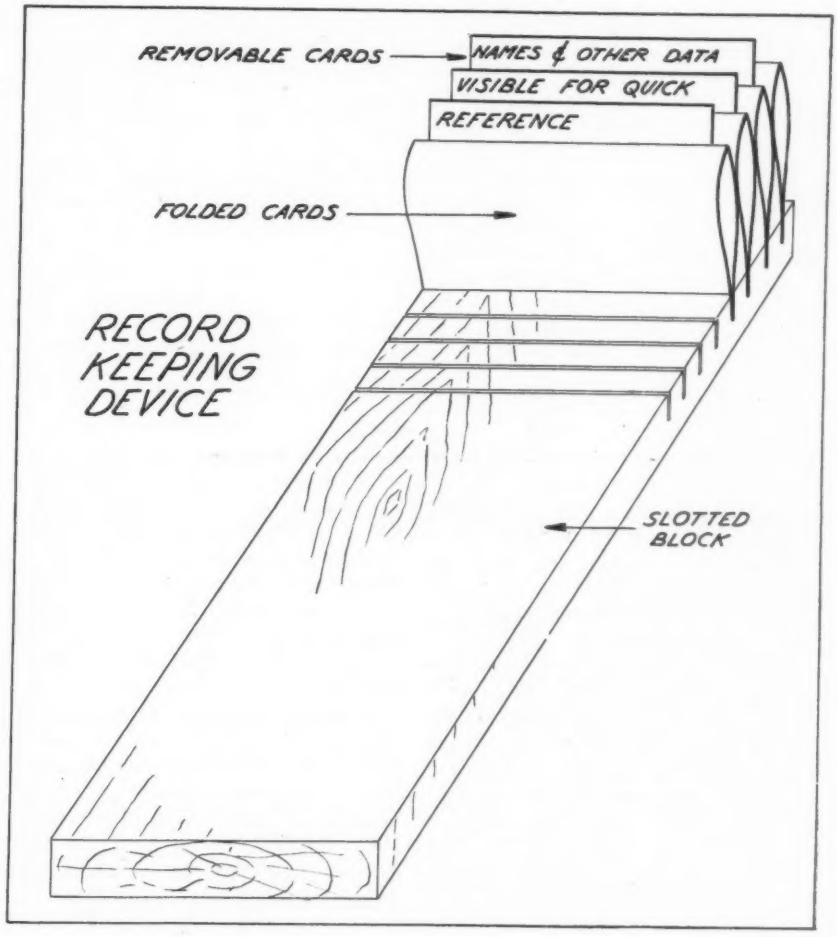


Fig. 7

covered. The pupil thinks, "more points, higher grade." The instructor thinks, "more points, more basic information covered," yet both work to the same advantage for the pupil.

This automatic job-selector device has proved to be a wonderful motivating factor, and it will tend to prevent pupils from getting into ruts in their work, and will keep them from asking to make the same thing over and over. This procedure is in line with progressive junior-high-school philosophy, for the more intensive development of specific skill in manufacture and fabrication is best left to schools dealing with older pupils.

Some thought should be given, here, to the grading scale used in connection with this system. A new pupil naturally has before him more opportunity than a veteran for new operations which he may learn. His first job is made up entirely of new operations. They all count on his record. On the second, and succeeding jobs, overlapping sets in. The opportunity for new ideas becomes more limited. Therefore, the pupil who returns to the shop for the second and third time should be given a definite handicap of points. The amount of this handicap, of course, should be determined by each individual instructor who may use the system. The following rating scale was developed to fit one set of shop conditions only, and it is given simply as an example of a form which might prove to be useful. It is based upon the A B C D F system of grading marks with a special certificate added for extra-fine work. Point numbers mean the number of points earned by a pupil in addition to his previous record. (One point for each new operation demonstrated.)

	D	*C*	*B*	*A*	*Special*
1st time in shop	5	10	15	20	30 (10 weeks)
2nd time in shop	3	5	10	15	20 (20 weeks)
3rd time in shop	1	3	5	10	15 (20 weeks)

It has been found advantageous to post such a rating scale in a conspicuous place where pupils can see it easily. If this is done, they can calculate their own standing at any time during the course and it will often be found that they work up private contests among themselves to see who can add the most points to his record. Another advantage of having such a definite basis for grading lies in the ease with which necessary reports can be compiled from data on hand. At the end of the term, one has only to add up the number of points earned by each boy and mark it in a convenient place on the personnel card for that boy. It is then an easy matter to mark beside it the grade letter to which that number of points entitle the pupil.

Selection of projects should be made with some care in order to cover nearly all the basic information involved in the ordinary course of work done in the shop for which the system is to be used. Should it happen that it is not convenient to cover the entire list of basic operations by means of projects, it is an easy matter to substitute specific exercises to bridge the gap. In fact, pupils should be given to understand that they may have their choice in the matter. They may either earn their points on organized projects, or may perform the operations singly for the same credit. The latter course will prove somewhat more difficult for the instructor unless the operations are grouped and graded in groups. This eliminates lost motion in checking.

If the instructor will provide himself with a set of clearly written instruction sheets (one for each basic unit shown on the master sheet), he will find himself equipped to carry out a really active program, for each boy can be given a job card and sent to the master chart to make a preliminary, automatic job analysis by key numbers, and then be referred to instruction sheets by the same numbers before he ever cuts into a piece of stock. Thus, he will have a picture in his mind of the processes he will use on his job. If job sheets are also provided for each standard job, and a model of the job is available, the boy will be well equipped for his work before actual fabrication begins. To institute this system means work, it is true, but the results are almost certain to justify the effort, and the conscientious instructor will feel amply repaid for his trouble.

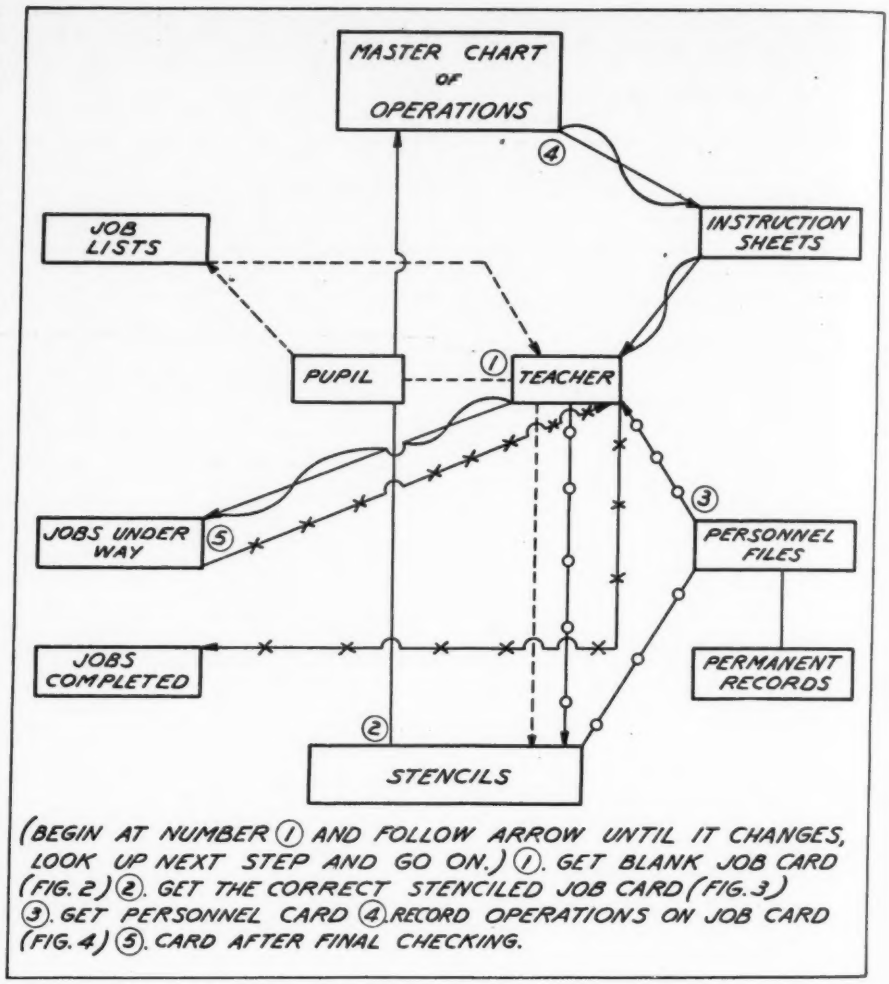

MASTER CHART OF OPERATIONS
JOB LISTS
INSTRUCTION SHEETS
PUPIL
TEACHER
JOBS UNDER WAY
PERSONNEL FILES
JOBS COMPLETED
PERMANENT RECORDS
STENCILS
(BEGIN AT NUMBER ① AND FOLLOW ARROW UNTIL IT CHANGES, LOOK UP NEXT STEP AND GO ON.) ①. GET BLANK JOB CARD (FIG. 2) ②. GET THE CORRECT STENCILED JOB CARD (FIG. 3) ③. GET PERSONNEL CARD ④. RECORD OPERATIONS ON JOB CARD (FIG. 4) ⑤. CARD AFTER FINAL CHECKING.

Fig. 8. Graphic illustration of system in operation

VOCATIONAL GUIDANCE

The proper distribution of men and women in the various occupations also constitutes an important step toward achieving economic security. Other things being equal, that country which is most successful in providing both opportunity and encouragement for every man to do the work for which he is best qualified should enjoy the greatest amount of prosperity. — *15th Yearbook, Department of Superintendence.*

Work Plan and Individual Progress Card

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Michigan State Normal College,
Ypsilanti, Michigan

The form described in this article can be adapted to almost any shop course. It can be effectively used in a number of ways.

The card form illustrated herewith has been found to serve two major purposes and numerous minor ones. A single card in the hands of a teacher provides a quick, practical method of recording specifically, by days or by weeks, the plan or outline for a semester's work in the shop and at home; and in the hands of each pupil in a class it serves not only for outlining the plan of the course but also provides a means of keeping a record of the work done each day both in the school shop and at home. The particular weeks to be devoted to certain types of work, dates when certain assignments are due, and many other things may be recorded on the cards to assist in following out a definite program and also in budgeting time and checking accomplishments.

The 8½ by 11-in. cards are made of fairly heavy stock. They may be retained by the pupils and kept in their notebooks or manuals or they may be kept in a filing cabinet in the shop where they are readily available at all times. The *term outline* or *work plan* portion of the card provides space for listing up to six different types or phases of work to be covered and also the approximate number of weeks to be devoted to each type or phase. This provides a general plan of the work to be done. The remaining portion of the card, as well as the back, is ruled to indicate days of the week with double ruling to indicate weeks. Five school days per week are indicated; this may be changed if Saturday work is to be recorded. A vertical line divides the *shopwork* from the *homework*.

To illustrate the use of the card, assume that a course of study in architectural drawing is to be planned, in which the following is to be included. The course will be given 5 days per week for 18 weeks: (1) Drawing and studying building plans, (2) drawing and studying construction details, (3) drawing elevations of buildings, (4) making perspective drawings, (5) making and studying plot plan drawings, (6) tracing and making prints of some of the drawings.

Consider carefully the content to be covered and estimate the approximate time to be devoted to each phase of the work. In this case, it is thought that it will require more time for construction details and perspective drawings than for the other parts of the work, and also that less time should be devoted to plot plan drawings and to tracing, so the time allotments are listed as 3, 4, 3, 4, 2 and 2, making a total of the 18 weeks to be devoted to the work. In some cases it is easier to determine these time allotments if the dates are filled in on the card and vacations are indicated or other days are marked which are to be devoted to certain things which may reduce the time available for actual shopwork.

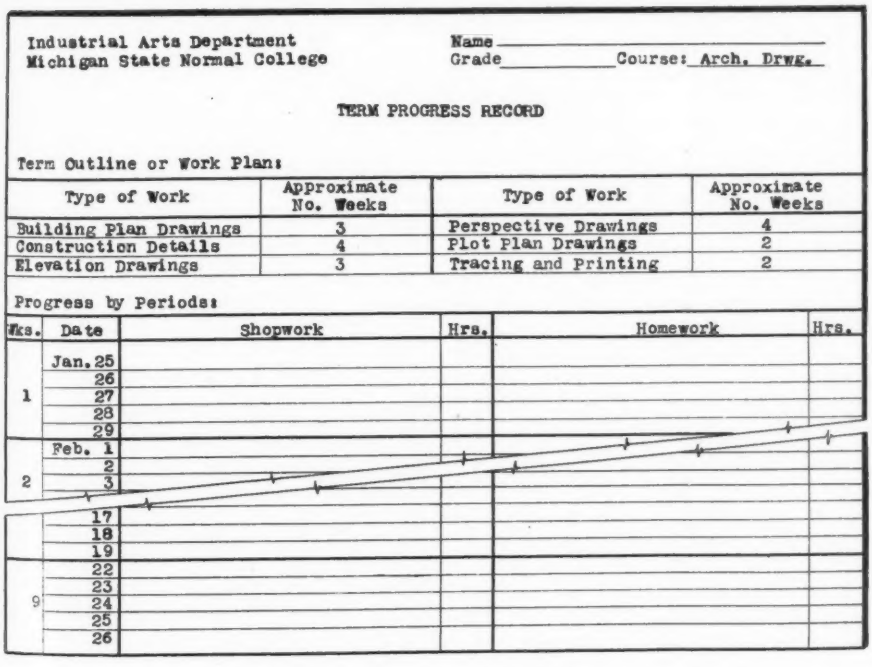
Number the weeks 1, 2, 3, 4, etc., along the left margin as indicated and put in the dates starting with the first day when a class is to be held (in this case January 25).

Draw horizontal lines to indicate the end of the third week (February 12) which is the approximate date when the work on drawing plans is to be completed and work on construction details is to be started. Draw lines also at the end of the 7th week to show the approximate date when work on elevations is to be started. Do the same for the remaining time periods so that approximate time limits are indicated for each type of work. The types of work to be done during the various periods of weeks may be written in the margin at the right to make the plan clearer.

The instructor may use the card further to write in specific things which are to be given on certain dates, list homework to be required, dates when certain drawings are to be handed in, etc. Thus, he may outline very definitely what is to be done and when.

The individual pupils may use the cards which they mark for themselves during the first class period as they are instructed to do by the teacher. This gives them a definite plan to follow and they may record or mark certain dates when tests are to be given or when things are due. They may then use the cards daily to record their progress each day, writing in the *shopwork* space what is done in school and under the *homework* heading what is done at home as well as the time devoted to it. If the pupils are absent, the spaces on the card should be left vacant.

If these cards are filled out carefully each day, listing just what is done they will give much valuable information which may be used by the teacher in improving his work as well as in checking up on the pupils. It may be found that too much time is being devoted to lectures rather



Industrial Arts Department
Michigan State Normal College

Name _____
Grade _____ Course: Arch. Drwg.

TERM PROGRESS RECORD

Term Outline or Work Plan:

Type of Work	Approximate No. Weeks	Type of Work	Approximate No. Weeks
Building Plan Drawings	3	Perspective Drawings	4
Construction Details	4	Plot Plan Drawings	2
Elevation Drawings	3	Tracing and Printing	2

Progress by Periods:

Wks.	Date	Shopwork	Hrs.	Homework	Hrs.
1	Jan. 25				
	26				
	27				
	28				
	29				
2	Feb. 1				
	2				
	3				
	17				
	18				
	19				
9	22				
	23				
	24				
	25				
	26				

Information continued on reverse side of card

than shopwork, that too much homework is required or that the time allotments should be changed when the course is offered the next time.

If the cards are used for general shopwork, where there is considerable difference in time allotments to several kinds of work which may be followed in various sequences, the pupils may mark the time periods as they start new types of work on the completion of previous types. Since these time allotments set approximate limits to assure completion of the required types of work, individual pupils may change from one type of work to another before the time allotment has been completed, provided the required work has been accomplished.

A Perpetual Shop Inventory System

Kenneth E. Parr

Ottawa, Illinois

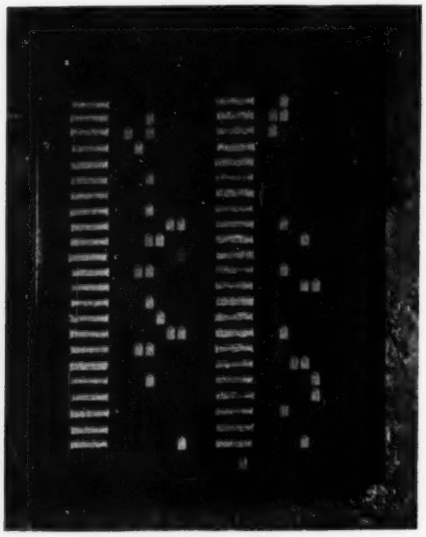
A simple but extremely useful method of taking care of an important phase of shop management.

As many shop instructors know, supply keeping is a business proposition and as such is often carefully observed by the school administration. The secret of a good stock of supplies lies in having just enough of each item, rather than too much or too little. We have all seen the teacher that purchased enough annealed copper sheeting to last five years, and we have also seen the teacher that promoted student discouragement by being out of stock on certain items most of the time. A good supply system should be continually moving out old stock and replacing it with new. This is called "turnover" in the business world.

The perpetual-inventory system described here was developed for the purpose of helping the instructor to keep a businesslike supply system. It has the following advantages over common methods of keeping supply records:

1. One can almost instantly find the amount on hand of any certain item.
2. One can accurately tell which items do, or do not, move.
3. One can quickly discover whether proper supplies are at hand for the construction of a certain project.
4. One can easily determine the exact selling price of supplies when the purchase price is constantly fluctuating.
5. One can instantly determine when stock-exhaustion danger points are reached.
6. The system can be maintained by the student.
7. Periodic inventories for the administration are quickly finished.
8. The amount of supplies used in any given period can be quickly determined.

The board shown in Figures 1 and 2 is made of ¼-in. fir veneer. Its area should be determined by individual shop conditions. The board illustrated is one of two used in the writer's shop, each having 46 items listed. Each stock item is lettered on a card and inserted into a cardholder constructed of open-hemmed tinplate tacked to the board. After each cardholder, a row of ten escutcheon pins follows. The distance between each pin will be determined by the size of tags used upon them. For the Dennison No. 340 tags used on the board illustrated, the pins should be spaced 1⅛ in. apart. These tags may be purchased at any office-stationery supply house in bundles of one hundred. At least three colors of tags should be used.



Perpetual-inventory board

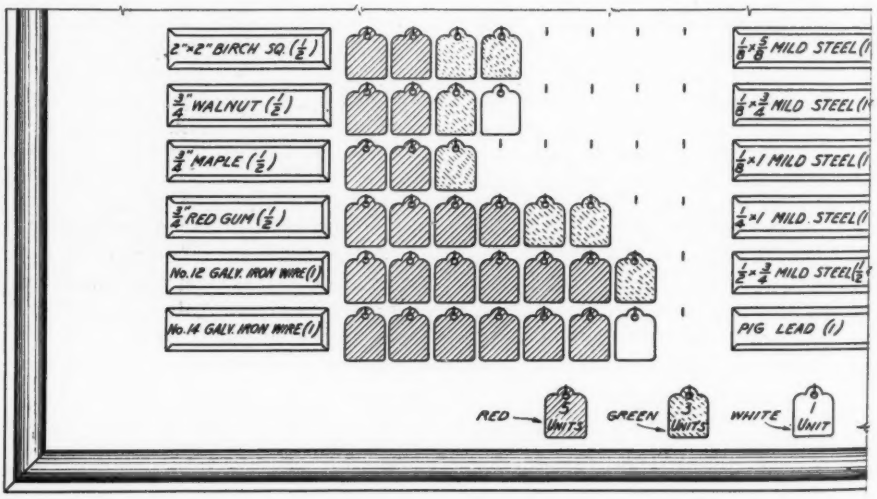


Fig. 1. Detail of inventory board

The board is used in the following manner. Each item card bears the *exact name* of the material, the amount of each *inventory unit*, and the *danger amount* as shown in Figure 1. *Inventory unit* means a common, easily figured amount of the material that is likely to be taken from the stockroom. For instance, for No. 12 galvanized iron wire, one lineal foot is the unit used on the board illustrated. The *danger amount* is the least amount of the material you wish to have on hand at any time. Following the item card, tags are hung on the escutcheon pins. These show the amount of each item on hand in the following manner: On the board illustrated, a red tag represents five inventory units of the material, a green tag represents three units of the material, and a white tag represents one unit of the material. For example, if 33 ft. of No. 12 galvanized iron wire are on hand, and one lineal foot is the inventory unit, there will be six red tags ($6 \times 5 = 30$), and one green tag (green $= 3$) hanging on the pins following the item card just as it is

shown in Figure 1. The selling price of each unit can be written on the back of each tag when it is put into place. If prices fluctuate, it will make no difference until a new supply is bought, because each unit is priced on the basis of its cost and will be sold that way.

The writer has had satisfactory success in having the students operate the perpetual inventory. A special space on the bill of materials and job-plan sheet is provided for the instructor's inventory O.K. This is given after the job plan is finished and when the student has drawn the necessary supplies and the equivalent in inventory tags. He labels the tags with the name of the item, hands them to the instructor, gets his inventory O.K. and goes on with his job. The number of tags then remaining on the board show the new status of the shop supplies. The old tags handed in by the students are kept in a special box, ready to be used again when new supplies are bought. If the box is dated, one has a method of finding how much of each item was used during the period shown on the box.

SHOP LAYOUTS

Finishing in the School Shop

Ralph G. Waring

Syracuse, New York

An excellent article on this important subject, written by an expert.

It has long been conceded among supervisors and shop instructors as well, that whereas the average cabinetwork and other construction in the school shop varies from good to very good, yet the finish given such products leaves much to be desired.

In order to ascertain the underlying factors responsible for this condition, I made a survey of some 75 school shops in a city of over 200,000, believing that this particular situation would give an adequate cross section of similar cities the country over.

This study showed quite conclusively, that only until the last five years has the school industrial-arts shop been given proportionately the same study and attention accorded the academic classroom. It is quite apparent in some of the older shops at least, that their placement has been largely a matter of indifference with but little consideration for the true educational value which can accrue from a well-placed, well-lighted, well-equipped, and properly administered school shop.

Practically no attention has been paid to the requirements for finishing-room space, and in many other instances, the matter of proper daylight and electric lighting was entirely inadequate and frequently incorrect or actually harmful to the eyes of pupils in shop classes.

Standard lighting engineering practice, dealing with the installation of adequate equipment, properly selected for both large and small plants, leads me seriously to recommend the use of standard "glass-steel diffuser" units of 300-watt and 500-watt capacity properly spaced and mounted. This unit (see Fig. 1) is of the most adequate design for shop use, gives light values which are correctly distributed, and is easily kept clean. Unlike the usual R.L.M. reflector installations, Figure 2, there is no "hot spot," to disturb the eyes, from the steel diffuser unit as is typical of the exposed bulb of the R.L.M. type. Where intricate work, close inspection, etc., prevail, then 25 foot-candles should be standard at 30 in. from the floor; while for general shop practice an average of 15 foot-candles should be maintained. This phase of the subject is worthy of serious consideration. Under no circumstances should mercury vapor lamps be used since matching of colors is impossible with that kind of illumination.

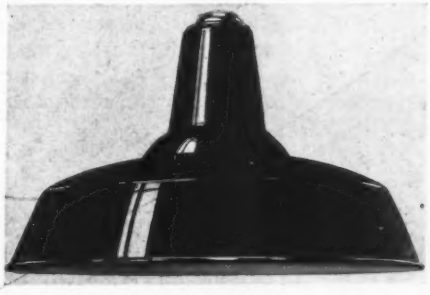


Fig. 2. R.L.M. reflector, 18-in.

The survey showed most conclusively that school authorities and instructors in general are all too prone to follow precedent without adequately studying the needs of the individual shop situation. The practice of arranging benches in solid squares leaves much to be desired. In the first place, it is inadequate from a teaching standpoint and discipline point of view. Secondly, it generally fails to take advantage of the available natural lighting, and third, it occupies a disproportionate amount of unit space per pupil station, without making any compensation lost for "set-up space," without which any shop is seriously handicapped. In very few cases, indeed, had any attempt been made to provide any space for a finishing room, although the survey showed ample space and facilities available in each case. The lack of a dust-free space for finishing, was the main contributing factor in preventing the production of suitable finishes on completed cabinet and industrial-arts products in general.

By way of illustration, Figure 3, shows a shop layout as it was developed in a continuation school by an instructor who had no real knowledge of the principles involved. This example has been chosen as

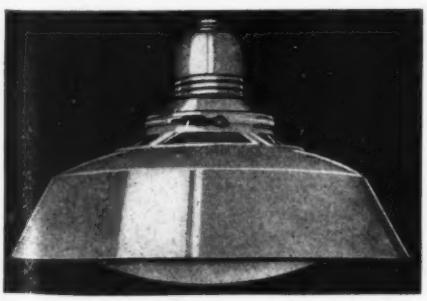


Fig. 1. 300-500-Watt steel diffuser unit, 20-in.

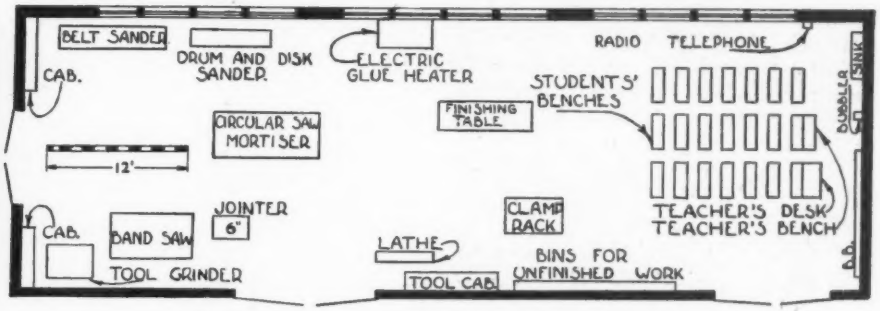


Fig. 3. Continuation-school shop as originally laid out

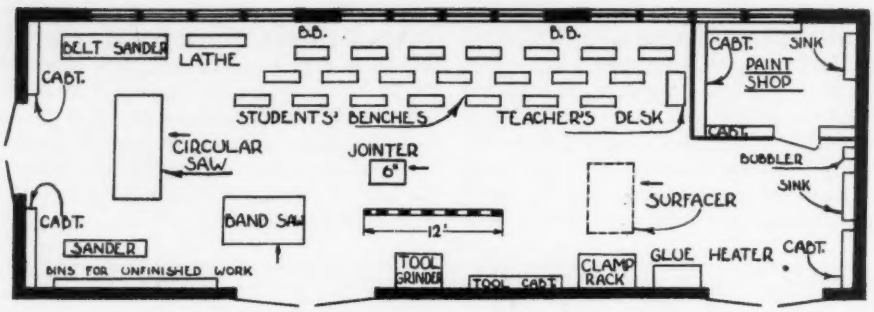


Fig. 4. The shop shown in Figure 3 with equipment rearranged

typical of school-shop layouts the country over and is no better nor any worse than similar examples encountered elsewhere.

In my twenty-five years of practice, I have yet to encounter a variety saw and mortiser which requires a 4 by 10-ft. floor space or a bandsaw which demands 4 by 8 ft., yet I have used these sizes as given and allocated them to their given positions as shown in Figure 4. Here all benches have perfect lighting conditions, and no boy works in the shadow of any other. For demonstrations, all boys are seated on the bench tops *with their backs to the light,* while the instructor faces them at a center bench in the row fartherest from the window. All benches are arranged in such a manner that the tool cabinet is centrally located. The grinder is *next* to the toolroom as it should be while the clamps and glue heater are placed out of the way but adjacent to a large "set-up" space where glue ladders, to hold the clamps, can be easily handled on saw horses. The clamp rack was placed as shown to prevent clamp ends from catching on clothes as shopworkers came through the corridor doors.

With the rearrangement of the benches, a space 10 by 14 ft. became available for locating the finishing room; using two outside windows and the sink installed as shown, since running water is most important in paint-shop operations. A single 500-watt steel diffuser unit is needed overhead for lighting during dark winter days. Cabinets are built 18 in. deep around the walls up to the 3-ft. level and the tops covered with sheet metal; while above this point, glass partitions are used both for general lighting purposes, as well as to enable the instructor to supervise work being done in the finishing room even though he may be out in the shop proper. If spray work is to be done, then provision must be made for exhaust and fume control which in this case could be best taken care of by exhausting into a water-spray cabinet and then immediately into the sewer. The door of the finishing room has been hung as shown to keep out all possible dust and should be weather-stripped at bottom. By extending the water and service lines, a new sink is provided for in the shop, adjacent to the bubbler.

The real benefit, beyond the space developed for the finishing room, is the change in layout of the machines shown in the original drawing. Study of the layout in Figure 3 shows that only 3-ft. stock can be handled on either the jointer or bandsaw. No long jointing or resawing is possible under these conditions, nevertheless, this is necessary. Again, the lathe was originally placed in the darkest portion of the shop rather than in the best lighted. In the new layout, the machines have more than sufficient space to handle even 16-ft. material, and if the future shows the need of a surfacer, space is available for even a 30-in. machine as shown in dotted line without seriously interfering with set-up space.

Blackboard space, while smaller than in the original layout, is adequate for such work as is necessary in shops of this type.

Special consideration should be given to

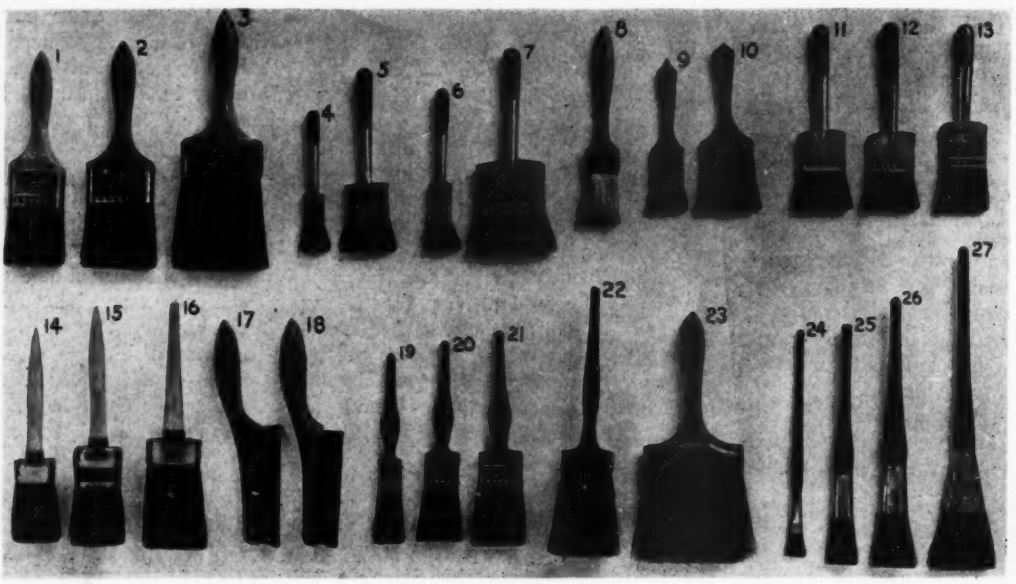


Fig. 5. Standard brush equipment for the paint shop

1, 2, 3. Standard 2-, 3-, and 4-in. wall brushes for paint; black china bristle—4, 5. Standard 1- and 2½-in. fitch brushes for shellac, lacquer, and varnishes; skunk and black-china bristles; single thick—6, 7. Standard 1- and 4-in. pure badger for varnish flowing; triple thick; full chisel—8. Standard 1½-in. white Russian bristle for varnish flowing and enameling; double thick; full chisel—9, 10. Standard 1- and 3-in. camel's hair for color coats only, for under coatings for a varnish schedule on automobiles—11. Standard 3-in. bear bristle for shellac, lacquer, varnish and enamel; double thick; full chisel—12, 13. Standard 2-in. Siberian ox hair for shellac, lacquer, varnish, and enamel, single and double thick respectively; full chisel—14, 15, 16. Standard 2/0, 6/0, 8/0 black-china oval, painter's general-purpose paint and varnish brush; center brush with tin bridle—17, 18. Standard ½-in. and 1-in. molding, scrubbing, or rubbing brushes for pumice and oil rubbing, or cleaning work—19, 20, 21. Standard 1-, 2-, and 3-in. black-china bristle, full-chisel, varnish-flowing, household general-purpose brush—22. Standard 2½-in. round, painter's duster—23. Standard 4-in. flat, painter's duster—24, 25, 26, 27. Standard ½-, ¾-, 1-, and 1½-in. oval sash tools for painting window sash; black-china bristle.

the specific problem of the paint shop itself. Simplicity should be the keynote in designing such space, and the equipment should be kept down to the minimum. If necessary, equipment may be fastened to the walls so that the latter may be cleaned and wiped at least once a week to keep down dust, the bane of all good finishing. Windows should be taped tight and not allowed to be opened at any time; the doors should have weather strips at the bottom on both sides to keep out all possible dust from the shop floor. Round, swivel-table tops, which can be made from old iron-base tables, and which can be locked stationary when necessary, are an absolute necessity, and should be covered with 26-gauge galvanized iron, well turned under to prevent cuts to fingers in handling. Several pairs of well-framed, light, painted hardwood horses, 36 in. high, should be made for the paint shop. A 24 by 36-in. rubbing frame, made of V-shaped strips tacked narrow edge up on 2 by 3-in. cleats also should be provided. This rubbing frame is used for supporting panels and similar wide work while allowing surplus rubbing sludge to drain off.

Brushes and their care alone constitute a very considerable problem in paint-shop maintenance. If the work is limited to varnishing, one type of equipment is required; if enameling and painting are part of the program, then still other types are required. Reference should be made here to Figure 5 showing standard brush equipment for the paint shop. From this list, the instructor can select such types as are best suited to his needs, remembering that the XXX black China bristle, rubber-set, double-thick, varnish-flowing brush will stand up best under average shop conditions if properly cared for. For shellac and best grades of varnishing, a few *single thick* 2- and 3-in. oxhair or fitch brushes will be most desirable.

The care of brushes and the condition of the bristles and ferrules are of vital importance. Under no circumstances should brushes be immersed in water while in storage. This form of malpractice has ruined hundreds of thousands of brushes the country over in spite of constant efforts to educate the public to the fact that such treatment softens and ruins the bristles so that they never regain their natural spring, and in addition may so swell the plug in the heel of the brush as to split the ferrule and render the brush worthless.

Brushes used in paint, varnish, or enamel should be kept in properly designed brush keepers and immersed partly up on the ferrule with a mixture of half turpentine and half varnish for the varnish brushes, and half turpentine and half raw linseed oil for enamel and paint brushes. When hung so that the brushes clear the container bottom by at least 1 in., the bristles work themselves clean and remain straight and resilient.

Reference to Figure 6 shows a properly designed keeper with slanting top, so designed as to prevent placing anything on top of the cover. The keeper illustrated here has kept the same brushes continuously since 1916 in perfect condition; amply long enough to demonstrate its practicality. Such keepers should be cleaned periodically; the varnish strained carefully, reduced with turps, and then restored to service. In Figure 7 is shown the use of a rotary can opener which removes the top of a can in such a way that when reversed, it fits snugly over the can body. With the top cut out to admit the brush handle as shown to the right in Figure 7, these cans make entirely practical brush keepers.

In many cases, brush pots with strike wires as shown in Figure 6 are not only very practical but most desirable. To have them clean, keep them immersed in a covered can of turpentine, then brushed out and rinsed in clean turps, or gasoline and turps mixed 50-50 just before using. Let dry by heat or air alone. *Do not wipe with a cloth* or the subsequent lint will ruin any varnish poured into the pan.

Brushes for water stains should be rubber-set bristles, preferably in a rubber-bound ferrule free of metal or leather. If used when new in a hot-water stain, the bristles will be soft and flabby in a short

Fig. 6. Standard paint-shop brush keeper and brush pot

Fig. 7. A temporary brush keeper

time. To avoid this, immerse the brushes in half turps and varnish in a brushkeeper for two months or more, using them to apply varnish to ordinary work from time to time and then return to the keeper until the soaking period is completed. Wash out the brushes in turpentine and lay out to dry after being sure that the bristles are completely cleared of varnish. When dry clear into the heel of the brush, wash completely in warm water and white soap, and after rinsing, the brush is ready to use. Such treatment insures that the bristles are thoroughly impregnated with varnish, that the heel of the brush is entirely sealed against the swelling action of water from the stain and that the bristles will never soften or twist when hot and wet. A brush cared for in this manner has been constantly in use since 1926 and today is still doing perfect work with walnut, mahogany, and maple water stains.

Fig. 8. A well designed supply cupboard

Next, we are concerned with an adequate supply cupboard, a very practical type of which is shown in Figure 8. Here the center column of metal-bodied drawers can be used for dry colors, brush storage, sandpaper, felts, putty knives, and the numerous other pieces of equipment used in the paint shop. The shelves should be on shelf-support strips so that easy cleaning or shelf readjustment is possible at all times. One drawer should be used at the bottom for *washed and sterilized white rags*, the other for white cotton waste used in rubbing operations.

Water stains alone should be used, and in this connection vehicles are supplied which when mixed 1:2 or 1:1 with water will prevent the raising of the grain when the stain is applied to the wood. Such a combination is most practical and economical, greatly exceeding the value of spirit or oil stains which have no place in a modern school shop, except where an occasional cheap or inexpensive job must be turned out as quickly as possible. Both oil and spirit types will fade very quickly when exposed to daylight near a window and can never produce as clear and fine finishes as the newer types of water and stain solvent.

As a further means to efficient administration of paint-shop materials and supplies, Figures 9 and 10 are offered to show a practical form of paint-shop stand which has stood the test of years, and a smaller paint-shop wall cupboard, suited to the conditions attending the operation of many industrial-arts shops. Here the prepared stains are stored in standard quart jars separated by heavy rubber bands to prevent cracking when someone in a hurry attempts to replace a jar after use. Since the inside face of the door panel is lined with galvanized iron, this forms a splendid shelf when the door is lowered and held in place by heavy elbow brackets which fold back into place when the door is closed and kept shut by a cupboard latch and two standard suitcase snaps.

It is practically impossible to make out a standard list of quantities for paint-shop requirements, since the conditions vary greatly from shop to shop even in the same city. Some instructors know practically nothing at all about finishing and as a result are content to apply a coat of spirit stain and a coat of wax, a more useless finish than this being hard to imagine. Such men should be required to study the subject intensively in extension courses and asked to work out a complete schedule of finishes in a year's time as a result of that enforced study. Regardless

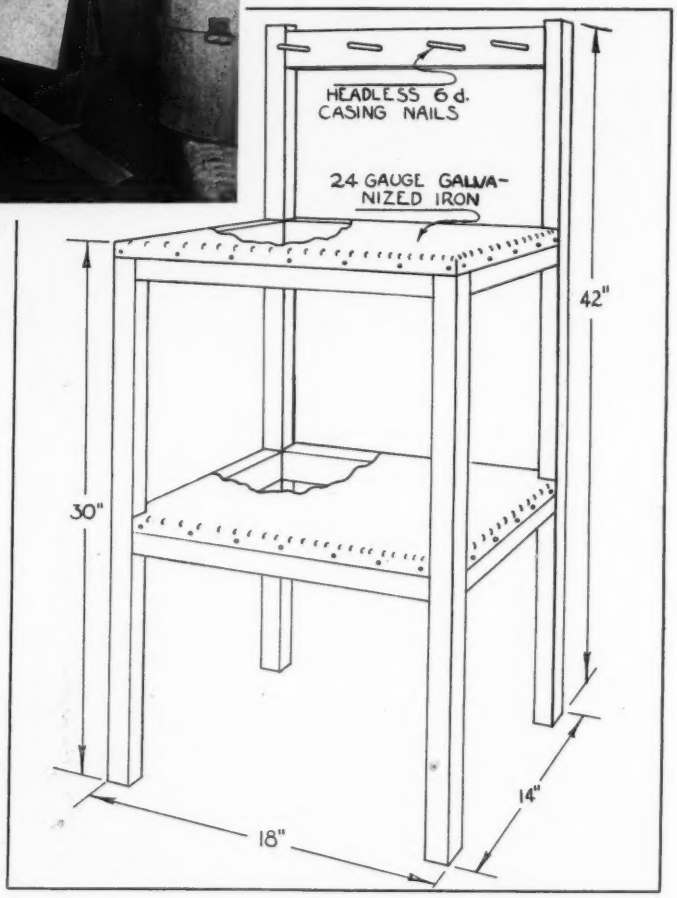


Fig. 9. Standard paint-shop stand, hardwood frame, galvanized-iron shelf tops

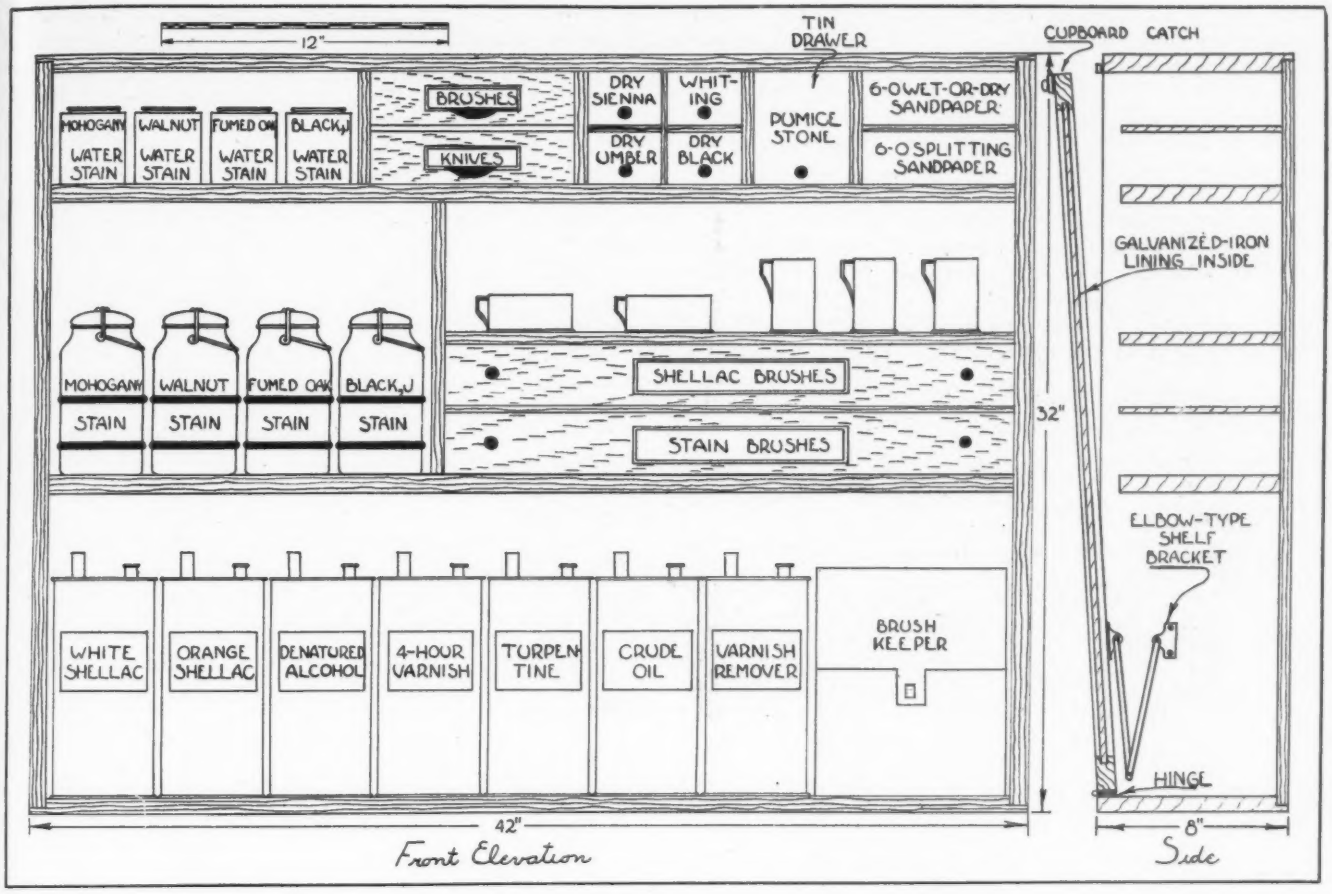


Fig. 10. Standard paint shop wall supply cabinet

of the quality of the cabinetwork, if the finish is inadequate, poor, or unsuited to the work in hand, then the material, time, and student labor are wasted. Worst of all, there is no educational return on the results of such instruction, and yet I have found instance after instance where this sort of thing goes on uncorrected for years.

On the other hand, the man who takes his job of instruction seriously, who has had actual trade experience or who has made a study of finishes and their application, should receive every possible encouragement, and should be given preference in opportunities, supplies, and equipment.

If such an instructor has demonstrated his training and ability in the products of his course of instruction, then his possible request for a spray-equipment unit to bring his instruction up to date, should be given serious and thoughtful consideration, As a guide in this respect, the portable sprayer in Figure 11 will do much to satisfy his requirements. By all means avoid the small, cheap, and wholly inadequate sprayers offered, remembering that in general, good spray guns require

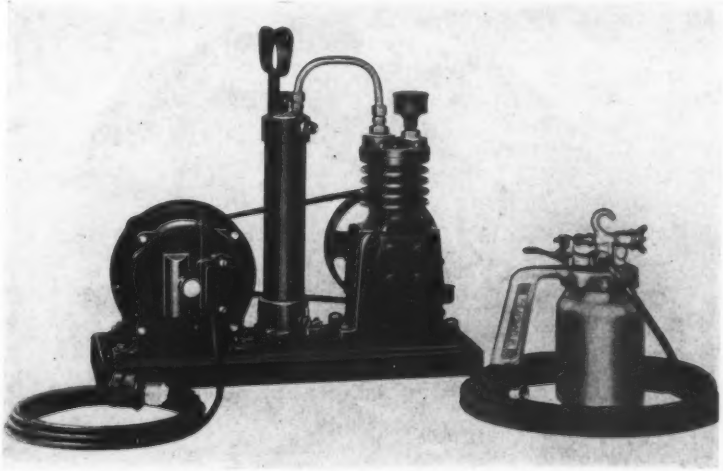


Fig. 11. DeVilbiss small portable unit, 110-volt

4 to 7 cu. ft. of air per minute at pressures varying from 25 to 60 lb., and that the cost of such adequate equipment will be proportionally high. There is, however, a principle in buying equipment that must constantly be kept in mind, that is, buy well-designed, adequate machinery manufactured and guaranteed by a reputable firm which ranks among the first three leaders in a given field. A "price buyer" gets exactly as much and no more than he pays for, and, all too frequently, less.

Finally, a few guides in buying supplies and equipment:

1. Buy for definite objectives. Build your equipment around your course objec-

tives, not the latter around machines on hand or about to be purchased.

2. Buy essentials. The trimmings can come later if ever.

3. Buy adequately — but no more. Equipment idle for any length of time is poorly chosen.

4. Buy as though the money were your own. Remember that taxpayers settle the bills and can ask embarrassing questions.

5. Buy only after you have carefully planned. Have your plans checked by recognized authority. You may be surprised to learn many things you did not understand.

Suggested list for class of 25 students in a course in wood finishing for 3 hours per week of forty weeks:

Brushes (all rubber set)

1 doz. 1-in. XXX Black China bristle, double thick
1 doz. 2-in. XXX Black China bristle, double thick
4 only 1½-in. Single thick oxhair or fitch
4 only 2½-in. Single thick oxhair or fitch
3 4-in flat dusters
3 3-in round dusters

Colors

Dry: 1 lb. each, raw sienna, burnt sienna, raw umber, and burnt umber, French ochre, chrome yellow medium, chrome green medium, carbon black

In oil: 1 lb. each, raw sienna, burnt sienna, raw umber, and burnt umber, French ochre, chrome yellow medium, chrome green medium, carbon black

Shellacs

2 gal. White shellac
2 gal. Orange shellac
Standard 4-lb. cut pure shellac

Varnishes

2 gal. 4-hr. gloss floor varnish
1 gal. 4-hr. flat floor varnish

Varnish Remover

1 gal. in quarts

Solvents

2 gal. Stain solvent for water-stain powers
3 gal. Denatured alcohol, shellac grade
5 gal. Turpentine, pure grain spirits

Stains

1 lb. Standard American Walnut, water soluble
1 lb. Standard American Mahogany, red, water soluble
1 lb. Standard American Mahogany, brown, water soluble
1 lb. Black, J, water soluble
1 lb. Yellow, Y, water soluble
1 lb. Orange, R, water soluble

Sandpapers

½ ream 4/0 Finishing, single thick
½ ream 6/0 Finishing, single thick
½ ream 6/0 Finishing, wet or dry

Silex

10 lb. for making filler

Whiting

2 lb. for putty

Putty

2 lb. Cold-water type
2 lb. Lead-oil type

Putty Knives

2 Flexible, 1 in.
1 Stiff, 1 in.
1 Flexible, 2 in.

Pumice Stone

3 lbs. FFF grade

Oil — Crude

1 gal. Standard Oil Co., rubbing grade

Oil — Linseed

1 gal. Raw linseed
1 gal. Boiled linseed

Oil — Paraffin

1 gal. Standard Oil Co., floor oil (golden)

Dryers

1 pt. Turpentine Japan

Steel Wool

1 lb. No. 2
1 lb. No. 00

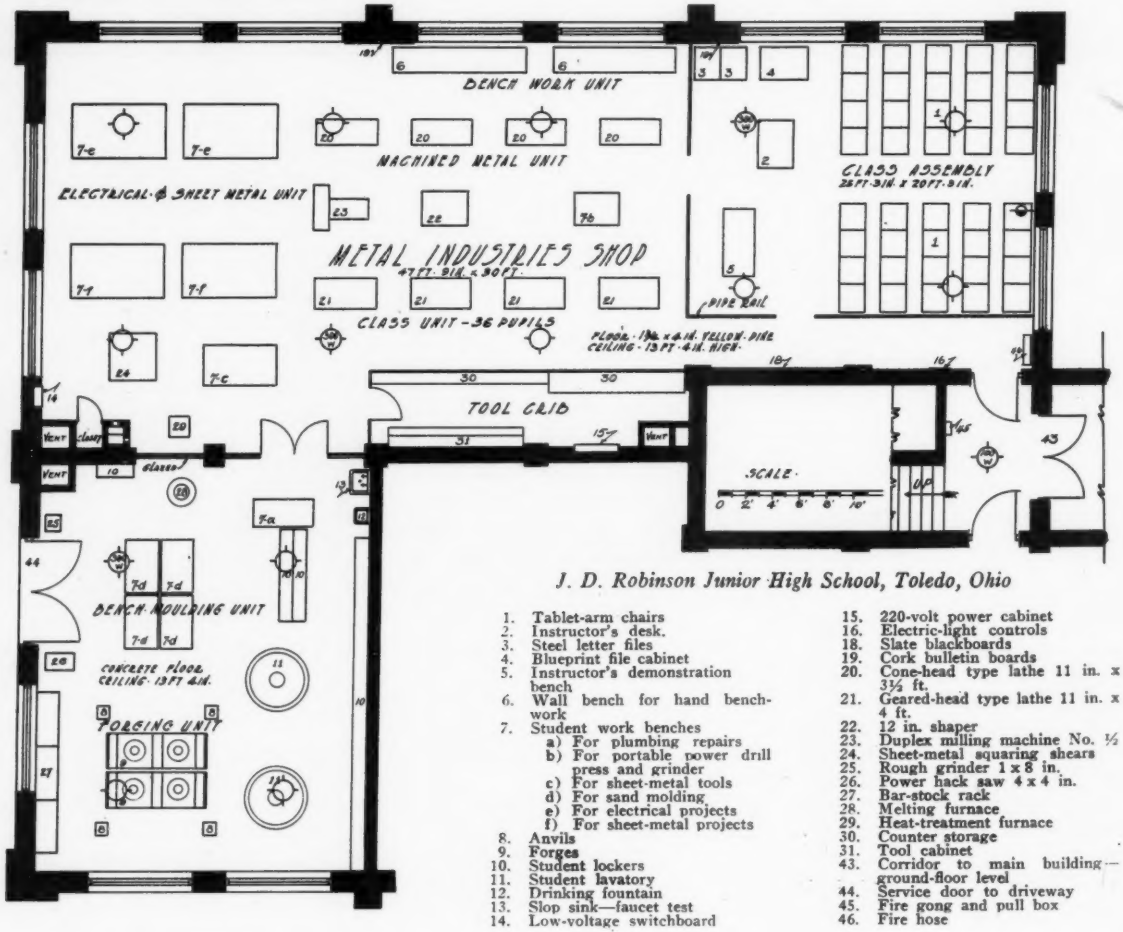
Rubbing Felt

1 lb. 1-in. Hard Spanish
1 lb. ½-in. Hard Spanish

Bibliography

Problems of Paint Shop Practices, Waring, The Bruce Publishing Co., Milwaukee, Wis.

Coloring, Finishing, and Painting Wood, A. C. Newell, Manual Arts Press, Peoria, Ill.



J. D. Robinson Junior High School, Toledo, Ohio

1. Tablet-arm chairs
2. Instructor's desk.
3. Steel letter files
4. Blueprint file cabinet
5. Instructor's demonstration bench
6. Wall bench for hand bench-work
7. Student work benches
   a) For plumbing repairs
   b) For portable power drill press and grinder
   c) For sheet-metal tools
   d) For sand molding
   e) For electrical projects
   f) For sheet-metal projects
8. Anvils
9. Forges
10. Student lockers
11. Student lavatory
12. Drinking fountain
13. Slop sink—faucet test
14. Low-voltage switchboard
15. 220-volt power cabinet
16. Electric-light controls
18. Slate blackboards
19. Cork bulletin boards
20. Cone-head type lathe 11 in. x 3½ ft.
21. Geared-head type lathe 11 in. x 4 ft.
22. 12 in. shaper
23. Duplex milling machine No. ½
24. Sheet-metal squaring shears
25. Rough grinder 1 x 8 in.
26. Power hack saw 4 x 4 in.
27. Bar-stock rack
28. Melting furnace
29. Heat-treatment furnace
30. Counter storage
31. Tool cabinet
43. Corridor to main building—ground-floor level
44. Service door to driveway
45. Fire gong and pull box
46. Fire hose

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Cutter one solid piece of high carbon steel ground and polished—end and side adjustment. Polished bottoms and sides. Rosewood knobs and handles. Top quality throughout.

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Heavy back reinforcement extends entire length of pistol grip handle, making it practically unbreakable. Excellent hang. Adjustable for 8" to 12" blades, which can be faced four directions. A high quality frame.

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Sizes 3/16" to 1 1/2"

For general all-round use. Solid stem or core runs entire length of twist, making very rigid, powerful tool with extra strength in head. Deep, clean screws. Keen spurs and cutting lips.

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Sweep 10"

Ball bearings at every possible point. Lion ball bearing chuck holds regular square shanks, No. 1 Morse Taper and round shanks ⅛" to ½". Boxed ratchet with ring shift. No finer bit brace made.

LANGDON ACME MITRE BOX

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If you contemplate the purchase of new equipment it will pay you to investigate these fine Millers Falls tools. The tools shown here are typical of hundreds that have established themselves as satisfactory and economical school shop equipment. The complete line includes Levels, Automatic Tools, Grinding Heads, Electric Tools, Screw Drivers, Hand and Breast Drills, Carving Tools, Punches and Chisels, Turning Tools, Hack Saw Blades, Precision Tools and many other items. See them at your dealers. They are illustrated and described in Catalog 41—free for the asking. Send postcard for your copy today.

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These maximum lists may be found helpful in checking inventories or preparing budgets.

Bench
- *a)* Shop, with hardwood tops, 1¾ in. or over in thickness, built up of strips with tongue-and-groove joints, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It is a good idea to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type.
- *b)* Glue
- *c)* Stain, with metal-covered top
- *d)* Teacher's demonstration

Blackboard — permanent or portable

Bookcase

Bulletin Board

Cabinets — wood or metal for filing class records, instruction sheets, drawings, etc.

Chairs — teacher's and tablet-arm

Core Oven — for patternmaking class

Desk — teacher's, with drawer compartments

Furnace — for melting soft metals (for patternmaking class)

Glue Pot — 1-qt. or 2-qt. electric, gas, or steam heat

Glue Warmer or Cooker — 1- to 5-gal. capacity

Grinder
- *a)* Automatic knife, direct-motor-drive type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b)* Bench, hand or power
- *c)* Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d)* Revolving oilstone, pedestal type, with one fine and one coarse oilstone

Jointer
- *a)* 6-in. or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, equipped with safety guard
- *b)* 12-in., 16-in., or 18-in. direct-motor-drive, ball-bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard

Lantern — Stereopticon-view machine for opaque objects and standard-type lantern slides

Lathes
- *a)* 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24 in., 36 in., 48 in., 60 in., or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b)* Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

Mortiser
- *a)* Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b)* Portable, vertical, hollow-chisel mortiser, bench type

Planer — 12-in., 18-in., 20-in., 24-in., or 30-in. motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

Saws
- *a)* Band saw, 20-in. to 36-in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b)* Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c)* Cut-off, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d)* Filing machine, direct motor drive
- *e)* Jig, direct-motor or belt driven
- *f)* Portable band saw, 16 in. to 20 in. ball-bearing, motor-driven
- *g)* Saw bench, direct connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h)* Universal saw bench, 14 in. to 16 in., motor driven
- *j)* Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly, The saw is to be equipped with ripping fence and miter cut-off gauges

Sander
- *a)* Belt, direct-motor-drive
- *b)* Disk, motor or belt-driven
- *c)* Oscillating-spindle, motor-driven
- *d)* Portable, hand-plane type, direct motor drive
- *e)* Vertical-spindle and disk sander

Shaper
- *a)* Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b)* Portable shaper or router with a suitable selection of cutters

Tenoner — single end, with coping heads and cut-off saw

Vises — rapid-acting or solid-nut type woodworking-bench vises, 7-in. to 10-in. face

Wood Trimmers — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

Awls — brad, assorted sizes

Bevels
- *a)* Protractor
- *b)* Sliding T, 8 in.

Bits
- *a)* Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b)* Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c)* Braces, ratchet-type, 8 in., 10 in., 12 in., or 14 in. sweep
- *d)* Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e)* Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f)* Expansive, ⅞ in. to 1½ in.
- *g)* Expansive, ⅞ in. to 3 in.
- *h)* Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j)* Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k)* Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l)* Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

Blowtorch

Brooms

Brushes
- *a)* Bench duster, 10 in.
- *b)* Floor
- *c)* Glue, round, 1½ in. and ¾ in.
- *d)* Glue, round, 1½ in.
- *e)* Marking, camel's-hair, No. 1 and No. 2
- *f)* Varnish, flowing, 2 in. and 2½ in.
- *g)* Varnish, flat, ½ in., ¾ in., and 1 in.

Burnishers — oval or round

Can Opener

Carving Tools
- *a)* Sets containing 6 tools
- *b)* Sets containing 12 tools

Chisels
- *a)* Cold, machinists', ⅜ in. and ½ in.
- *b)* Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c)* Socket-firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d)* Socket-firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e)* Tanged-firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1¼ in.

Clamps
- *a)* Bar, 24 in., 36 in., 48 in., and 60 in.
- *b)* Hand-screw, 4 in., 5 in., 6 in., 7 in., 8 in., 10 in., 12 in., and 14 in.
- *c)* Malleable-iron C, 4 in., 6 in., and 8 in.

Dividers — wing, 6 in. and 10 in.

Dowel Plate — 6 in. long

Doweling Jigs — with bushings

Drawknives — 7 in.

Drill
- *a)* Automatic hand, with 8 drill points
- *b)* Chuck, 0 to ⅜ in.
- *c)* Hand, 0 to ⅜ in., for round-shank drills
- *d)* Star, for concrete, ½ in. and ¾ in.

Files
- *a)* Auger bit, assorted, 6 in.
- *b)* Cabinet, 8 in. and 10 in.
- *c)* Card and brush
- *d)* Flat, wood, 10 in.
- *e)* Mill, bastard cut, 10 in.
- *f)* Round, bastard cut, 12 in.
- *g)* Taper, slim, 5½ in. and 7 in.

First-Aid Cabinet and Supplies

Gauges
- *a)* Bit, adjustable
- *b)* Jointer
- *c)* Marking, metal or hardwood
- *d)* Mortise, metal or hardwood
- *e)* Panel

Glass Cutter

(Continued on page 12A)

Huther Bros. Saw Mfg. Co.

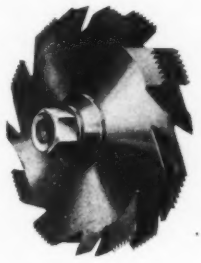
1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head



Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

Angular Hub Groover

(New Patent No. 1782507)

This Groover was designed to cut end grooves in hard wood and to clear itself easily without swage or set. Clearance is effected by angular grinding of hub. Light adjustment. Used on regular saw mandrel without extra collars.

High Speed Knives

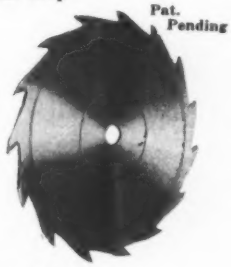
Shaper Stock, Ground Flat Stock

We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

Band Saws

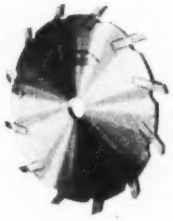
We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

New Steady Rim Rip



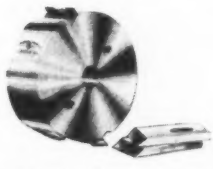
This is an extra smooth cutting Rip Saw designed for smooth cutting at fast feed. This is the smoothest cutting Rip Saw we have and is capable of beautiful work.

Inserted Tooth Groover



This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

Cutter Heads for Saw Mandrel



Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

Saw Vise

Setting Stake

These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

(Continued from page 10A)

Gouges
- *a*) Tanged-firmer, outside ground, handled, ⅛ in., ¼ in., ½ in., ¾ in., 1 in.
- *b*) Tanged-firmer, inside ground, handled, ⅛ in., ¼ in., ½ in., ¾ in., 1 in.
- *c*) Spoon, ½ in., ¾ in., and 1 in.

Hammers — claw, bell-faced, 10-oz., 12-oz., 13-oz., 16-oz.
Hatchet — bench, 4 in. cut
Jars — earthenware, 1-qt. capacity
Knives
- *a*) Jointer, to fit power machine
- *b*) Planer, to fit power machine
- *c*) Sloyd, 3 in. blade

Levels
- *a*) Wood, 24 in.
- *b*) Machinists', 12 in.

Mallets — hickory, 3 in. by 5 in. head
Nail Sets — 1/16 in. and 3/32 in. points
Oilers — bench, 1/3-pt. coppered, best grade
Oilstones
- *a*) 1 in. x 2 in. x 8 in. in iron box
- *b*) Gouge slip, medium, 4½ in. x 2⅛ in. x ⅝ in. x 5/16 in.
- *c*) Gouge slip, fine, 3 in. x 2 in. x ⅜ in. x ⅛ in.

Pincers — 6 in. carpenters'
Pinch Dogs — ¾ in., 1 in., and 1¼ in.
Planes
- *a*) Block, adjustable, 6 in. long, 1⅝ in. cutter
- *b*) Circular
- *c*) Combination, adjustable
- *d*) Core box
- *e*) Duplex, fillister and rabbet
- *f*) Fore, ⅛ in., 2⅜ in. cutter
- *g*) Irons, double
- *h*) Jack, 14 in., 2 in. cutter
- *j*) Jointer, 24 in.
- *k*) Round, wood, 1¾ in.
- *l*) Router
- *m*) Smooth, 9 in., 1¾ in. or 2 in. cutter

Pliers
- *a*) Round-nose, 5 in.
- *b*) Side-cutting, 6 in.

Putty Knives
Rasps — half round, wood, 10 in.
Rules
- *a*) Board
- *b*) 1 ft. or 2 ft. graduated by 8ths and 16ths
- *c*) Shrink, ⅛ in., 3/16 in.

Saws
- *a*) Back, 12 in., 14-point
- *b*) Band, ¼ in., ½ in., ¾ in., to fit power machine
- *c*) Compass, 10 in.
- *d*) Coping, frames
- *e*) Coping, blades
- *f*) Crosscut, 9-tooth, 22 in. long
- *g*) Crosscut, circular for power machine
- *h*) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
- *j*) Hack, frames, 8 in. or adjustable
- *k*) Hack, blades, 8 in.
- *l*) Keyhole, 10 in., 10-point
- *m*) Rip, 7-point, 22 in. long
- *n*) Rip, circular for power machine
- *o*) Set, 10 points per inch and finer
- *p*) Set, 10 points per inch and coarser
- *q*) Turning frame, 14 in.
- *r*) Turning blades, 3/16 in. x 12 in., 10-tooth
- *s*) Miter-box, 24 in. x 4 in. saw, 7 in. capacity at miter

Scrapers
- *a*) Cabinet
- *b*) Glue, triangular
- *c*) Veneer, blade 2¾ in. long, handle 11 in. long

Screw Drivers
- *a*) Cabinetmakers', 4 in., 6 in., and 8 in.
- *b*) Quick-return, spiral ratchet

Shoot Board — and plane
Snips — tinners', forged steel, 2½ in. cut
Spokeshaves — adjustable, raised handle, 10 in. long
Squares
- *a*) Combination, 12 in.
- *b*) Try-, iron handle, 8 in.
- *c*) Framing, 2 ft.

Steel Figures — hand cut, ⅛ in.
Tapeline — 50 ft. steel
Trammel Points — adjustable metal frame, steel points
Turning Tools (for 12 lathes)
- *a*) Calipers, 6 in. inside and outside
- *b*) Calipers, 12 in. inside and outside
- *c*) Parting tools, ⅛ in.
- *d*) Round point, ¾ in., ½ in., ¾ in.
- *e*) Spear point, ¼ in., ½ in., ¾ in.
- *f*) Square point, ¼ in., ½ in., ¾ in.
- *g*) Turning chisels, ¼ in., ½ in., ¾ in.
- *h*) Turning gouges, ¼ in., ½ in., ¾ in.
- *j*) Turning skews, L.H., ¼ in., ½ in., ¾ in.
- *k*) Turning skews, R.H., ¼ in., ½ in.

Vise — 3 in. jaw anvil face
Wrenches
- *a*) Adjustable, 8 in., 10 in., and 12 in.
- *b*) Headless setscrew, ¼ in. to ⅝ in. by 16ths
- *c*) Pipe, 10 in. and 12 in.
- *d*) S-type or open-end type to fit ⅛ in. to 1 in. U.S.S. nuts

Woodworking—Materials and Supplies

Alcohol
Benzine
Brads — ⅜ in., ½ in., and ⅝ in. No. 20; ¾ in. and ⅞ in. No. 10; 1 in. No. 18; 1¼ in., and 1½ in. No. 16; 1¾ in. No. 15; 2 in. and 2½ in. No. 14
Carbon Paper — black
Colors — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Van Dyke brown, and vermilion
Colors — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Van Dyke brown, and vermilion
Decalcomania Transfers
Dowel Pins and Plates
Dowels: hardwood, 3-ft. lengths, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
Enamel
- *a*) Selected colors
- *b*) Undercoater

Fillers — paste: natural, golden oak, dark oak, and mahogany
Fillets — leather, ¼ in. and ½ in.
Glue
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

Hardware: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports
Hooks
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

Lacquer — black, clear, cobalt blue, ivory, medium green, red, thinner, white and yellow
Lumber — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine
In ordering pine, mill-run kiln-dried will be found suitable for carpentry, while short, select, kiln-dried 4 in. and wider or No. 1 shop common, kiln-dried will be required for cabinetmaking and patternmaking
Hardwood, for furniture, should be specified first and second grade, kiln-dried, standard widths and lengths, or short lengths
Moldings
Nails
- *a*) Common, 6d, 8d, and 10d
- *b*) Flat-head, ½ in. No. 20, ¾ in. No. 19, 1 in. No. 18, 1¼ in. and 1½ in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

Oil
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

Overlay Carvings
Panel or Plywood — 3-ply, 5-ply, and 7-ply
Pattern Letters
Pins — escutcheon
Pumice Stone — No. 0
Rapping Plates
Rottenstone
Sandpaper — Garnet, No. 1, ½, 0, 2/0, 3/0, 4/0, and 6/0, wet or dry finishing
Garnet paper can also be obtained in rolls of 50 yds. each, and in widths 3 in. and up
Screw Eyes
Screws
- *a*) Flat-head, brass, No. 3 x ⅜ in., No. 4 x ½ in., No. 5 x ⅝ in., No. 5 x ¾ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1¼ in., No. 10 x 1½ in., No. 12 x 1¼ in., No. 12 x 1¾ in., No. 10 x 2 in.
- *b*) Flat-head, bright, No. 3 x ½ in., No. 4 x ½ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1 in., No. 10 x 1¼ in., No. 8 x 1¼ in., No. 14 x 1¼ in., No. 10 x 1½ in., No. 12 x 1½ in., No. 10 x 1¾ in., No. 12 x 1¾ in., No. 10 x 2 in., No. 12 x 2 in., No. 14 x 2 in., No. 12 x 2¼ in., No. 14 x 2¼ in., No. 14 x 2½ in.
- *c*) Oval-head, brass, No. 5 x ¾ in., and No. 10 x 1¼ in.
- *d*) Round-head, blued, No. 3 x ⅜ in., No. 3 x ½ in., No. 5 x ¾ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1¼ in., No. 10 x 1½ in., No. 12 x 1½ in.
- *e*) Round-head, brass, No. 2 x ⅜ in., No. 3 x ⅜ in., No. 4 x ½ in., No. 3 x ⅝ in., No. 5 x ¾ in.

Shellac
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

Note: Shellac should be kept in glass or earthenware containers
Stains — oil, spirit or water: Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut
Steel Wool — No. 0 and No. 00
Turpentine
Twine
Varnish — coach, flat, remover, spar, and rubbing
Waste — cotton, white
Wax — bees and finishing
White Lead

Take-About Sanders Are Raising Manual Training Standards in over 2500 Schools

Ideal equipment for instruction in industries' modern sanding methods. Raise the standard of work and turn out projects with an expert finish by using a Take-About Sander—so easy to operate and so simple to own. Read how maintenance savings quickly pay for it.

Porter-Cable Take-About Sanders Serve Double Purpose

Besides being ideal equipment for the Manual Training Department, the Take-About Sander offers the quickest, easiest and best way to refinish desks, tables, cabinets, woodwork, slate blackboards, marble laboratory benches, etc.

Save $1.45 on Every Desk

The average cost of resurfacing desk tops with a Take-About Sander is ten cents. This includes labor, material and machine depreciation. Compare this with the average cost of $1.55 per desk for refinishing by hand and you can easily see the big saving the Take-About makes. Let us give you an actual demonstration of the Porter-Cable Take-About Sander—see how it resurfaces 12 to 20 desk tops per hour without removing them from the class room.

$.017 Per Square Foot

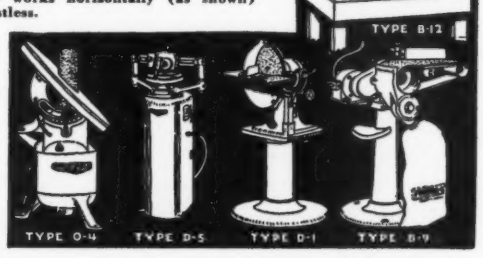
That was the cost of resurfacing the floors in the Livingston, Mont., schools according to a letter recently received. This included labor, sandpaper, interest on investment and depreciation of machine. It repaid its full purchase price in a single vacation period of two months. Classrooms, halls, gymnasium, cafeteria and laboratory floors were resurfaced without hiring outside labor.

Smooth Floors Less Care

Hundreds of schools are using Speedmatic Floor Sanders for renovating old floors. It is surprising how easily and quickly your own janitor or maintenance man can resurface floors at very little cost with a Speedmatic Floor Sander. No experience is necessary. The construction of these machines assure a fast, smooth even job that saves floor maintenance materials and labor.

Belt and Disc Grinders

B-12 Belt Sander for bench use. Unexcelled for flat grinding.
O-4 Oscillating Spindle Sander saves time and labor in pattern-making and wood-working operations.
D-5 Lapping Machine for lapping and free-hand grinding.
D-1 Disc Sander, dustless and adjustable.
B-9 Belt Grinder works horizontally (as shown) or vertically. Dustless.



PORTER-CABLE also builds 20″ Band Saws, and other equipment for School Maintenance and Manual Training departments.

MAIL THE COUPON TODAY

PORTER-CABLE MACHINE CO., Syracuse, N. Y.

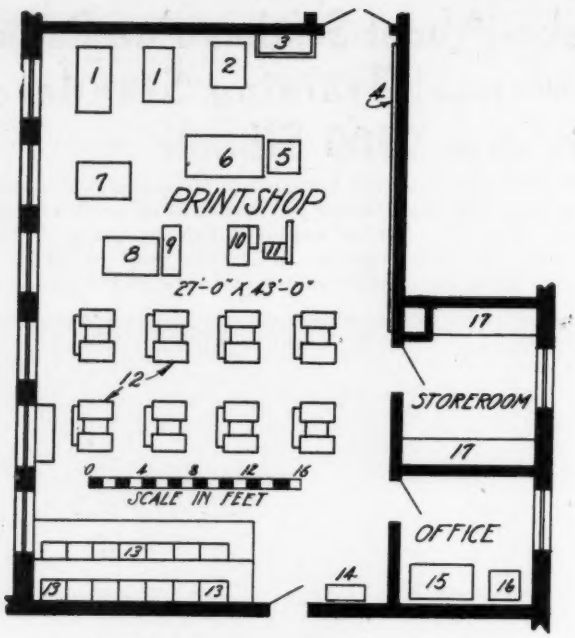
Please send a copy of your FREE School Equipment Catalog. I'm interested in the following equipment:

.....

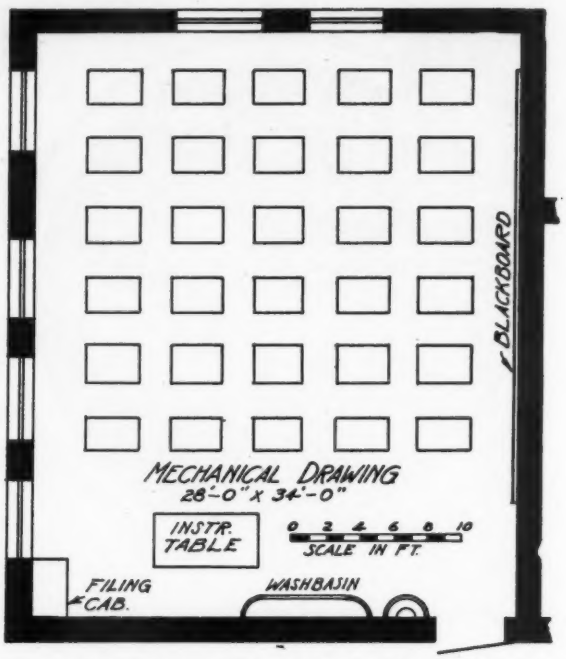
Name..... **School**.....

St...... **City**..... **State**.....

The PORTER-CABLE MACHINE COMPANY
1702-3 N. SALINA STREET—SYRACUSE, N. Y.

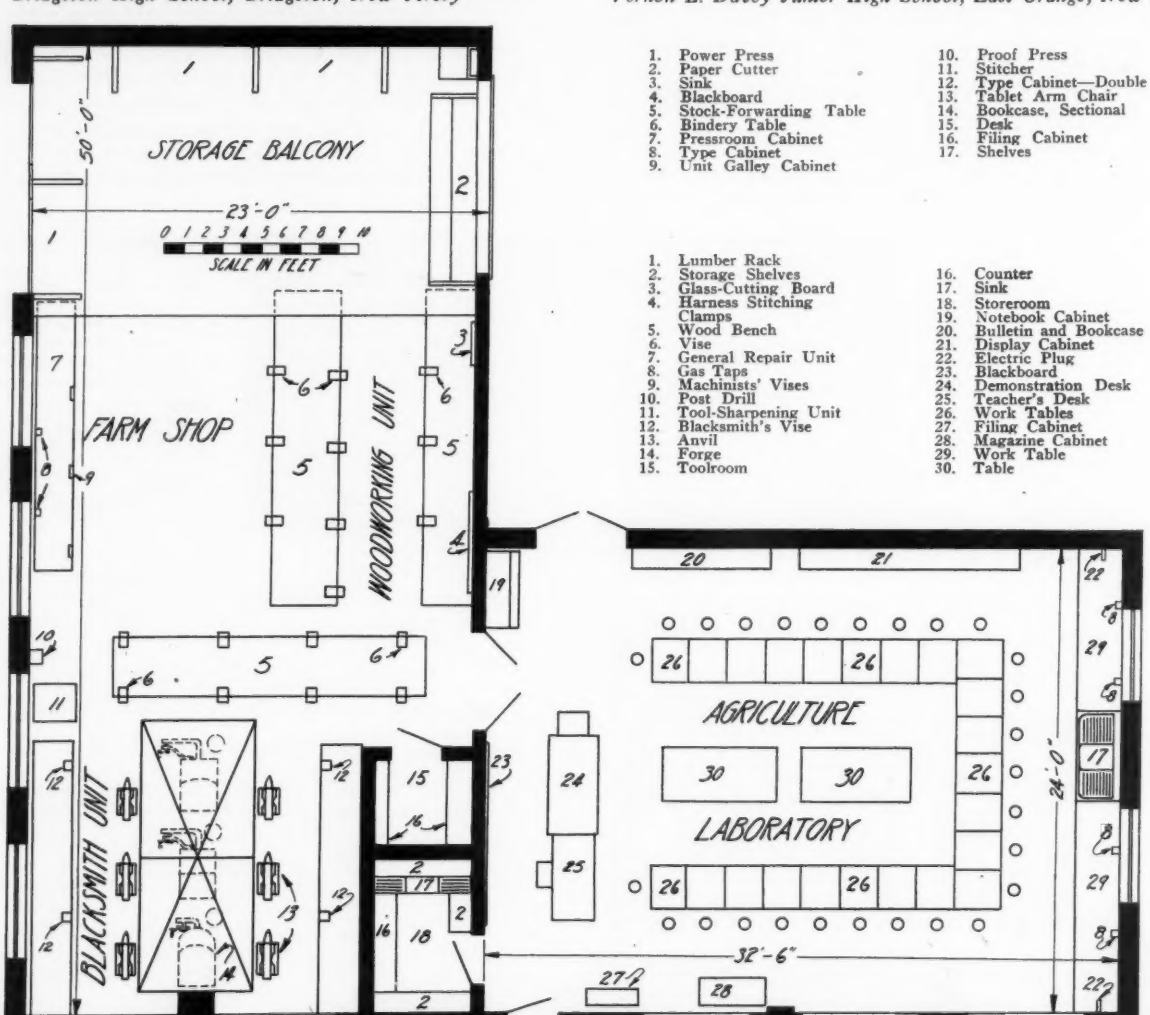


Bridgeton High School, Bridgeton, New Jersey



Vernon L. Davey Junior High School, East Orange, New Jersey

1. Power Press
2. Paper Cutter
3. Sink
4. Blackboard
5. Stock-Forwarding Table
6. Bindery Table
7. Pressroom Cabinet
8. Type Cabinet
9. Unit Galley Cabinet
10. Proof Press
11. Stitcher
12. Type Cabinet—Double 8
13. Tablet Arm Chair
14. Bookcase, Sectional
15. Desk
16. Filing Cabinet
17. Shelves



1. Lumber Rack
2. Storage Shelves
3. Glass-Cutting Board
4. Harness Stitching Clamps
5. Wood Bench
6. Vise
7. General Repair Unit
8. Gas Taps
9. Machinists' Vises
10. Post Drill
11. Tool-Sharpening Unit
12. Blacksmith's Vise
13. Anvil
14. Forge
15. Toolroom
16. Counter
17. Sink
18. Storeroom
19. Notebook Cabinet
20. Bulletin and Bookcase
21. Display Cabinet
22. Electric Plug
23. Blackboard
24. Demonstration Desk
25. Teacher's Desk
26. Work Tables
27. Filing Cabinet
28. Magazine Cabinet
29. Work Table
30. Table

Sheridan High School, Sheridan, Wyoming

SUPERVISION

Duties of the Head of a Department

Merle F. Perry

Head of the Vocational Department,
W. Wilson Intermediate School,
Detroit, Michigan

A thoughtful analysis of the duties of the head of a vocational department made by the incumbent of such a position.

The expansion of the high school and intermediate school has increased the problems of administration. Most schools have a principal and an assistant principal who devote their entire time to administration. Larger schools make necessary larger groups of teachers in the schools, teaching in the same general fields of education. For administrative purposes, teachers engaged in the same field of instruction have been grouped into departments. One teacher from the group is designated head of the department or chairman of the group. The duties of the department head are clerical, semi-administrative, and are becoming more and more concerned with educational supervision.

Educational supervision within a building should originate in the office of the principal and assistant principal. However, it is obvious that they lack the specialized knowledge and skill necessary for effective supervision in many of the various departments; it is only natural, therefore, that this duty should be delegated to the head of each department because of his superior knowledge in the field of his specialization.

The outline presented herewith, represents an effort to determine the duties of the head of the vocational department in an intermediate school. It may be varied, of course, to suit the particular situation.

A. Know the aims and purposes of the educational system of which his school is a part.

1. Supply his teachers with this information by means of literature and individual or group conferences as may seem necessary and advisable for the good of the system, his school, and the teacher.

B. Know the policy of his principal.

1. Inform his teachers of this policy insofar as it concerns them and their work, and stimulate them to co-operate wholeheartedly.

C. Know the policy and aims of the director of his particular branch of study.

1. Inform the principal of this policy, and discuss with him the application and methods of attaining these aims insofar as they concern his school.

2. Inform the teachers of this policy insofar as it concerns the teacher in his work, and stimulate him to co-operate in the application.

D. Know the judgments of the subject supervisors with respect to each of his teachers.

1. Co-operate with him in stimulating teacher growth.

2. Inform him of the deficiencies of teachers who may be lacking certain necessary qualifications, and work with him in making corrections.

E. Keep in touch with the assistant principal when he is planning the program.

1. Give him information that he may need.
   a) Teacher's ability to teach a subject.
   b) Equipment available for classes.
   c) Room capacity.
   d) Adjustments necessary.
   e) Make constructive recommendations.

F. Equipment.

1. Know equipment necessary for instruction.
2. Check to see if equipment is on hand.
3. If not on hand, see if available.
4. If available, requisition it.
5. If not available, see what adjustments or changes may be made.
6. Know the condition of equipment in use.
7. Keep equipment replacements up to date.
8. Be in a position to make recommendations as to kinds and make of equipment.

G. Supplies.

1. Check with teacher to see what is needed.
2. Find out whether the material wanted is available.
3. Requisition the items that are available.
4. Make necessary adjustments or changes.
5. Be in a position to make recommendations as to types and qualities of needed supplies.

H. Tests and measurements.

1. Know what tests should be given and when.
2. See that the teachers have all necessary materials.
3. See that results are turned in on time.
4. Know how results compare with city scores.
5. Study scores with teachers.

a) If not good, work with teacher to determine reason and solution of problem.

6. Study the teacher's distribution of grades, as an indication of teaching ability.

a) Help him to formulate a satisfactory grading system if necessary.

J. The teachers in the building.

1. Stimulate harmony and co-operation between teachers in the department.
2. Stimulate harmony and co-operation between teachers in his own department and those of other departments.
3. Help to develop a sociable atmosphere.

K. Other Schools.

1. Know the types of work being done in other schools.
2. Know in which the best work of a specific kind may be found.
3. Know the techniques used to advantage in other schools.
4. Know what teachers are considered good in each branch of study in other schools.
5. Stimulate a feeling of fellowship with teachers in other schools.

L. The teacher at his work.

1. "Specifically, the duties of a head of department are to ascertain that each teacher in his group:

a) Is adequately equipped with knowledge of the subject assigned to him.

b) Makes careful preparation for the teaching of each class.

c) Presents his subject matter skillfully, using appropriate assignments, questions, problems, and drill devices.

d) Secures and maintains interest, and so prevents interruptions which would call for disciplinary methods.

e) Maintains the best possible physical conditions for teaching.

f) Uses the most economical elements of class management.

g) Properly co-ordinates his work with that of his colleagues.

h) Progresses according to schedule, at the same time maintaining good standards.

i) Distributes his attention to all pupils of the class.

j) Makes proper provision for individual differences of ability."*

M. Teacher growth.

1. Encourage and be interested in experimentation.
2. Encourage a professional spirit.
3. Encourage a feeling of confidence.
4. Praise progress, no matter how small.
5. Make available and encourage the latest educational reading, especially that of direct interest to the teacher in his fields of work and interests.
6. Inform them where good work is being done elsewhere in the city and arrange for them to visit. Be sure to talk the visit over with them later.
7. Use the individual or group conference meeting instead of the department meeting except when it is for the common good of all in the department.
8. Do not offer criticism without offering an abundance of praise at the same time.

*Report of the Survey of the Public Schools of Philadelphia. Book II, pp. 107, 108.

(Continued on page 16A)

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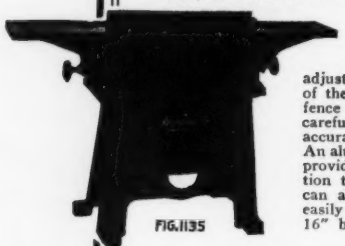
Woodworking Machines

are modern, fast, accurate, sturdy, moderate in price; made of the finest materials and embody the best of workmanship and finish. Minutest attention is given to each machine to insure accuracy, trouble-free operation, long service, the utmost in safety.

MONARCH 8" BALL BEARING JOINTERS

This precision tool designed especially for school use, has built in it the sturdiness to withstand hard, continuous service; is available either as shown, with a built-in motor on the cutterhead, or it can be furnished with a pulley for belt drive. The tables are extra long. The round cutterhead is of improved safety design, permitting a positive adjustment for the setting of the knives. The tilting fence is of modern design carefully ground to insure accurate working service. An aluminum safety guard provides absolute protection to the operator. We can also furnish modern, easily operated, 12" and 16" ball bearing jointers.



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The newly designed MONARCH 20" and 30" heavy duty band saws are of latest design, comply with the most rigid requirements of all safety regulations. They are heavy and rugged and will withstand years of hard, continuous service. Every moving part is fully guarded except the portion of the saw blade in the cut. Wheels can be either cast iron spoke type or aluminum disc type. Machines ball bearing throughout. Both machines are furnished with foot brake on the bottom wheel.

MONARCH HIGH SPEED WOOD TURNING LATHES

Fig.1115

These lathes are accurate, modern and rigid. They are designed to meet the severe requirements of school work. The beds are strong, well ribbed, one piece castings; may be had in various lengths. Lathes can be furnished either with the New Departure variable speed "Transitory" motor mounted in a cabinet type leg, or the standard 4 speed motor headstock lathe as illustrated, or with the standard motor in leg with belt drive, or with the 4 step comb type belt drive. These lathes are modern in every respect.

We will be glad to furnish on request a copy of our new modern catalog just published, describing all MONARCH Woodworking machinery.

American Saw Mill Machinery Co.

74 Main St. Hackettstown, N. J.

(Continued from page 15A)

9. Do not criticize without leaving a suggestion for the teacher to consider.

10. Consider any suggestion that a teacher may offer. Discuss it with him.

11. Arrange for visits, don't just drop in.

12. Have the forethought to say yes, and the courage diplomatically to say no.

13. Lead the teacher to feel that you are just as interested in his work as he is.

14. Help the new teacher orient himself.

15. Do demonstration teaching if necessary.

16. Help the teacher to better himself if he is worthy and desires promotion.

17. Help the ambitious teacher to progress in the field of his major interest.

18. Encourage membership in, and support of, worthy teachers' organizations.

N. Inventory.

1. Keep an up-to-date inventory of equipment and supplies.

2. Delegate the job to the teacher concerned but check with him.

3. Keep a classified list of equipment in each room.

O. Records.

1. Have a system of records and keep them up to date.

2. Delegate the job to the teacher concerned but check with him.

3. Keep a record of all information given to, or relayed to teachers and superiors. It is for everyone's protection.

P. Avoid clashes; there is a better way.

Q. Be able to take orders in the right spirit.

R. If you find time enough to hold a grudge, your job is too small for you.

Helping the Teacher

William N. Miller

South Philadelphia High School, Philadelphia, Pennsylvania

Twelve excellent suggestions given by a principal to his teachers and supervisors.

Those who are in executive positions in high schools know only too well the differences in the personalities of teachers, and one of their greatest tasks is to help teachers who fall below the required standards.

A department head can do much in helping the young teachers make their careers successful. Great care must be exercised in supervising the beginner teacher. Criticisms must be given him in the form of suggestions, in a kindly, constructive manner. Careful note of teaching errors must be made without any ostentation in the classroom. A personal talk with the teacher in private during off periods will usually accomplish much good, if the teacher is really earnest in his desire to succeed. Many young teachers drop out of the teaching profession, or have stormy careers, simply because they were not properly guided in the early years of their teaching.

The following fine points, taken from the teaching and supervising experience of Mr. F. C. Nieweg, Principal of South Philadelphia High School, will be helpful to teachers generally.

"1. A teacher must always be a learner. He can never know it all; and much that he learns must come through enlightening, enriching, and mellowing experience. In his younger years, a teacher is likely to be guided by theory and his head; in later years by experience and his heart.

"2. A boost that raises a boy's spirits is always worth more than a knock that depresses him. Anything that humiliates a pupil in the presence of others is a serious mistake.

"3. In discussing troubles with a boy, his response and frankness are in proportion to the understanding and decency shown in the teacher's approach. A boy is often helped by being given a 'break' rather than a penalty.

"4. An attitude of suspicion is blight-

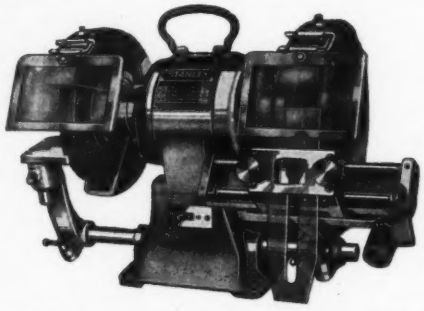
(Continued on page 20A)

Stanley Electric Tool Division

THE STANLEY WORKS

Educational Department, New Britain, Connecticut

Stanley Portable Electric Tools



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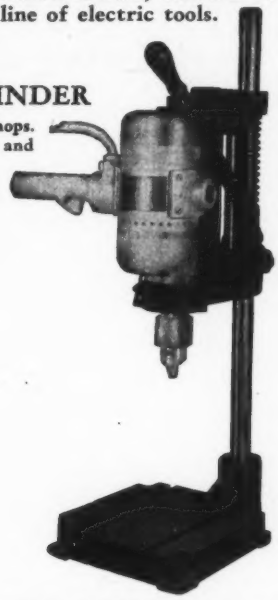
STANLEY Electric Tools are made to the same careful standards as Stanley Hand Tools, which are favorites in the educational field and for eighty years have maintained a reputation for high quality. Write for Catalogs No. 61M and 64M, which show the complete line of electric tools.

"MIGHTY MIDGET" UNISHEAR

Cuts up to 18 gauge iron, 16 gauge aluminum, and other metals in proportion. Also leather, fiber and cardboard. Cutting speed up to 3" a second. Weighs only 6½ lbs; easier to handle than a pair of snips. 100% safe. Cuts straight lines, curves, angles and notches with hair-line accuracy. Universal motor. Voltages 110, 150, 220 or 250, as specified.

PLANE IRON AND CHISEL GRINDER

No. 567—7" Wheels, designed for woodworking shops. Grinding attachment holds all sizes of plane irons and chisels, so that any boy can grind a perfect bevel. Equipped with special tool grinding wheels. Ball bearing motor operates at slow speed of 1725 r.p.m. Equipped with safety wheel guards. Safety glass eye shields furnished if desired. For A.C. 110 volts and D.C. 115 volts.

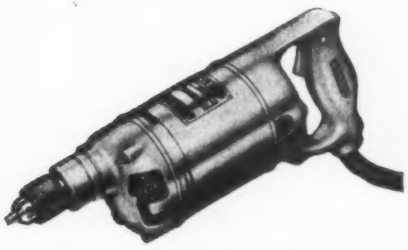


ELECTRIC DRILL NO. 121

½" Standard Duty Tool, very powerful, popular for heavy drilling. Universal motor mounted on oil sealed bearings, strong aluminum alloy housing, automatic safety switch, built-in drill gauge and "can't-lose" chuck key.

DRILL STAND NO. 535

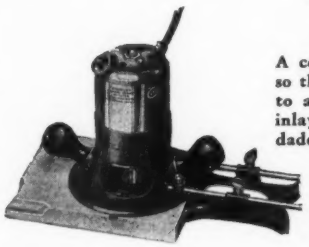
Stands may be supplied for either wall or bench use, converting any Stanley Electric Drill into a powerful drill press. Bench Stand No. 535, illustrated, with Stanley Electric Drill No. 582, provides a heavy duty drill press for school use. No. 582—⅜" Heavy Duty Drill is very popular for heavy construction and machinery repairing.



ELECTRIC DRILL NO. 142

This ¼" Heavy Duty Drill has all the features of the biggest Stanley drills. The straightline housing permits close work in corners or against walls.

Stanley Electric Router-Shaper

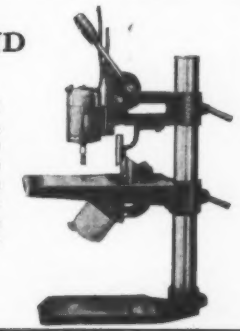


HAND ROUTER NO. 10

A compact machine, easily handled so that free hand cuts can be made to a knife line. Ideal for routing, inlaying, veining, panel work, dadoing, etc. A compact ⅛ H.P. Universal Motor for 110 volts constitutes the power unit. Equipped with heavy duty ball bearings, runs at 18,000 r.p.m.

COMBINATION BENCH ROUTER AND SHAPER NO. 30

The same power unit may be used in the over arm for bench routing, mortising, inlaying, etc., or may be transferred to the holder under the table and used as a shaper. This holder may be tilted 45° so that it requires but three or four cutters in various combinations to make hundreds of moulding cuts.



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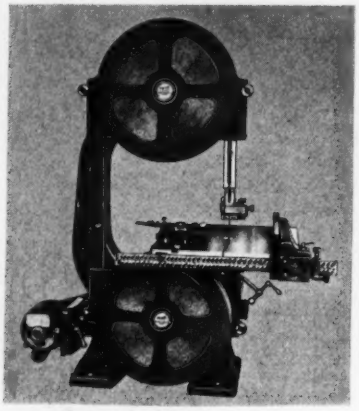
STANLEY ELECTRIC TOOL DIVISION, Educational Department, 112 Elm St., New Britain, Conn.

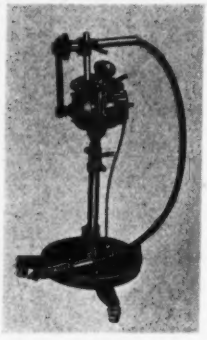
SERIES 900 BELT AND DISC UNIVERSAL SURFACER

A full production tool that does belt and disc sanding, plus "stroke" surfacing of any length panels up to 30" wide. Surfaces wood, metal, plastics, fibre, other materials with ease and speed. 4 SKF dust-sealed ball bearings, efficient dust collecting system, four speeds, scores of other important features. Smaller model available.



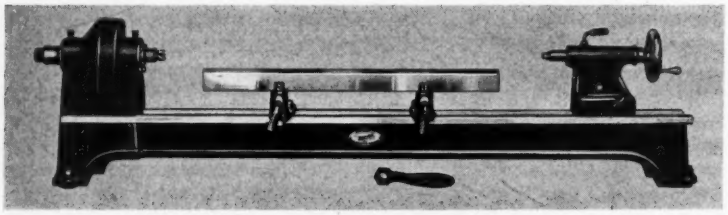
SERIES 1100 16" BAND SAW

Cuts true, without vibration. Rugged. Completely guarded for full protection of the operator. These features, plus its powerful, graceful lines, have earned for this band saw the approval of every shop instructor who has seen it. 12" cutting capacity, 16" throat. Heavy one piece frame, SKF ball bearings, many other advantages that put it in a class by itself. Two smaller models also built by Walker-Turner.



PR102 HEAVY DUTY FLEXIBLE SHAFT

Innumerable jobs can be done by the addition of a few accessories to this powerful flexible shaft outfit. Sanding, grinding, drilling in difficult places; cleaning, buffing, and polishing can be done with equal ease. Shaft is 5' 4"–½" long, rubber covered, with SKF ball bearing hand piece. Sturdy construction characterizes this tool throughout. Smaller models available.



SERIES 900 WOOD TURNING LATHE

Designed to meet the exacting requirements of commercial pattern makers and advanced craftsmen. Massive construction, unusual precision and high quality features are evident in every detail of this lathe. The hollow head spindle (⅝" inside dia.) is precision ground to close limits. Morse Taper centers. SKF ball bearings. 37" between centers, 10" swing. Heavy construction permits this lathe to do accurate metal turning, with only the addition of the compound tool rest. Four other Driver Lathes of smaller capacity available.

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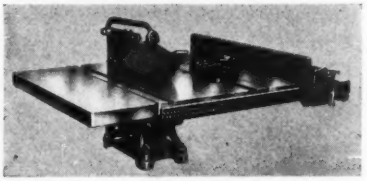
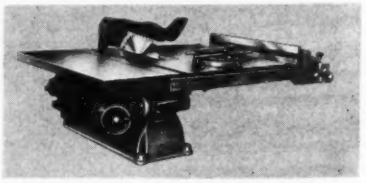


SERIES 941 8" BENCH SAW

This new Walker-Turner tool combines the latest triumphs of Walker-Turner engineers in features for safety, performance and easy operation. New "kick-back pawls" prevent stock being thrown back by blade. Powerful table tilting and arbor raising devices. Real safety guard and splitter, ripping fence of correct length. Big table, with plenty of room in front of blade. 2¼" cutting capacity.



SERIES 961 10" BENCH SAW

This is the tool that has proved the favorite in school shops everywhere. Full 3" cutting capacity. SKF ball bearings. Geared self-indexing mitre gauge. Two smaller Walker-Turner Bench Saws available.

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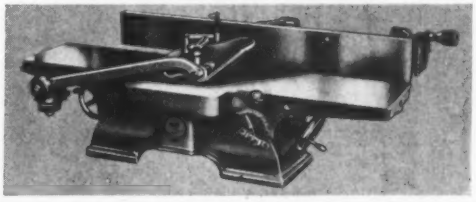
Versatility, ruggedness, and safe, easy operation were the primary considerations in the design and construction of these Walker-Turner Tools for the school shop. Study the catalog, or see them at your dealer's, and you'll agree nothing has been overlooked to make these sturdy tools the best that money can buy — and at the same time, keep their cost within the reach of the typical school shop budget.

SERIES 1100 TILTING ARBOR SAW

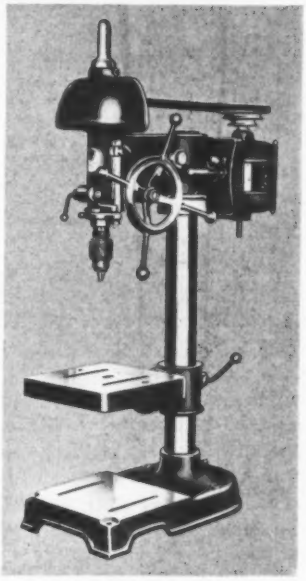
If your shop has never owned a tilting arbor saw, you've missed the convenience of a tool that's ideal for angle cuts in large or unwieldy stock. This model has a massive, rigid frame, 35" x 26" table, full horsepower motor, heavy duty SKF ball bearings, 10" blade. Heavy tilting unit swings accurately, almost without effort. Cuts 3¼" hardwood — greatest capacity ever offered in this price class.

SERIES 900 PRECISION 6" JOINTER

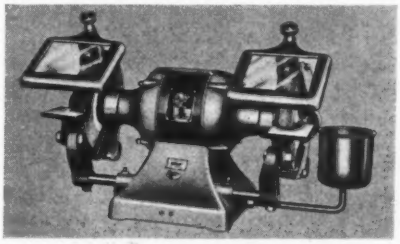


Dual purpose guard provides real safety, also permits stock to be held against cutter and planed to ribbon thickness. 3 high-speed steel knives. Length of table, 33"; width, 7⅜". SKF ball bearings. Sturdy cast iron fence, 28" long. Protractor depth gauge on front table. Operating speed, 4,000–5,000 r.p.m. Available with all-steel bench and belt guard. Two smaller jointers also made by Walker-Turner.

SERIES 900 DRILL PRESS



The exclusive Walker-Turner 6 spline spindle cuts vibration to a minimum. 4 SKF ball bearings, one above and one below pulley, two in quill. Jacobs (0" to ½") Key Chuck. Spindle travel, 4". Maximum distance chuck to table 12", to base, 17". Table tilts at any angle. Locking device holds spindle in any position. Head may be inverted on column for spindle shaping. Four speeds. This drill press has proved itself on steady production in many industrial plants. Also available in two lighter models.



GR50 MOTOR GRINDER

½ h.p. capacitator type motor, with built-in condenser, that affords plenty of overload capacity. Large grease-sealed SKF ball bearings. 7" x 1" wheels. Guards that provide full protection. Snap switch mounted in base. Smaller Walker-Turner Grinder also built.

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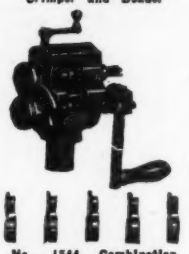

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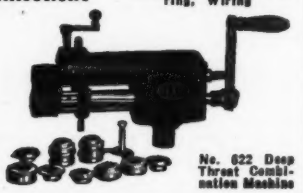
No. 63 Adjustable Bar Folder with Counter Balance



No. 622 Deep Throat Combination Machine

(Continued from page 16A)

ing to student-teacher relations. Evidence of a teacher's confidence is a challenge, an inspiration, and a control in a boy's life. In his teens, 'a feller needs a friend,' and the teacher can be that understanding friend. It is better to be deceived than to show unwillingness to take a boy's word.

"5. A school can be run with few rules and without scolding boys. While the law is to some extent a schoolmaster and we cannot dispense with it entirely, the wishes of a respected teacher are vastly more controlling and molding in a boy's conduct and ideals than rules and threats can ever be.

"6. The gulf between the slow boy and the bright boy is not necessarily impassable. Poor work at school is often due to causes that are removable and not inherent. Every now and then, a tortoise beats a hare, both in school and in later life.

"7. A boy's interest in a subject is often determined by the inspiration he gets from the teacher's own interest in his subject.

"8. The teaching gift is a matter of personality rather than training. Training is necessary, but all the training of all the schools cannot make an inspiring teacher of a man who does not work with himself to develop the right kind of personality.

"9. A teacher's example is more effective than a volume of precepts.

"10. It is better for a student to learn a smaller number of subjects well, rather than to learn many subjects superficially. The quality of learning and knowing is more important than the subject matter. Slovenly learning in school leads to slovenly working and living in later life. The passing grade in business or professional life is not 60 or 70 per cent.

"11. The most important thing in teaching and learning is not the *what* but the *how*. *What* to learn and *what* to think is important but *how* to learn and *how* to think is vastly more important. The great prehistoric animals perished and disappeared from the face of the earth because they could not adapt themselves to changes in their environment. We are facing rapid changes in our social and economic climate, and in order to survive and thrive, our young people must be able to learn, to think, to interpret, to evaluate — and to adapt themselves. This is no time for fixation except in quality of motive and character.

"12. The development of character is more important than the gaining of knowledge."

Good health, clear, straight thinking, integrity, and good will toward all — these should always be the objectives of the teacher for the pupil.

Judging Industrial-Arts Teachers

Floyd T. Walker

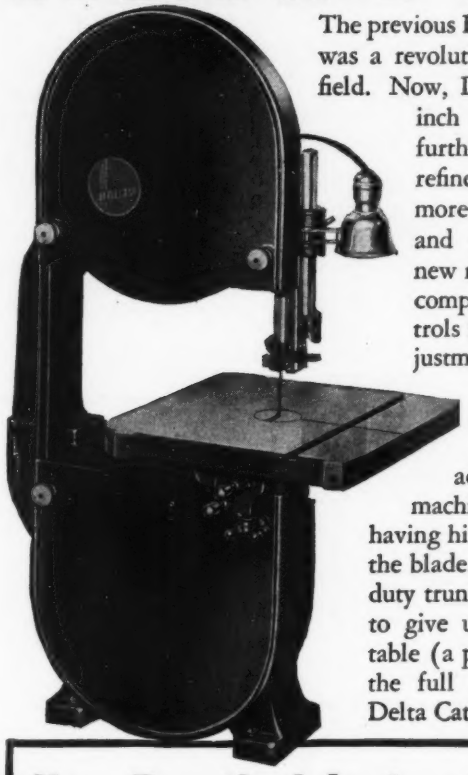
High School,
Lapel, Indiana

The criteria here set up, also may be used by the industrial-arts teacher for self-evaluation.

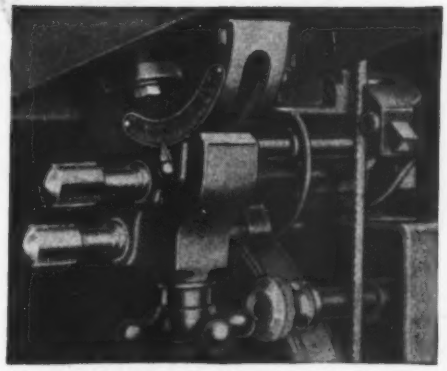
The average school administrator has difficulty in establishing suitable criteria for judging teachers in any department. This is true because all worth-while subjects are progressive and because it is difficult for administrators to keep "up-to-date" on such a variety of subjects. It is also difficult to distinguish between criteria for judging applicants for positions and

(Continued on page 22A)

A New 14-in. Band Saw



The previous Delta 14-inch Band Saw was a revolutionary new tool in its field. Now, Delta offers a new 14-inch Band Saw with still further improvements and refinements making it still more convenient, more rigid and safer to use. In this new model, both wheels are completely enclosed. Controls for the lower guide adjustments are brought out to the front of the table, so that the operator can make the final adjustments while the machine is running without having his hands anywhere near the blade. There are new heavy duty trunnions spaced far apart to give utmost rigidity to the table (a patented feature). For the full details see the 1937 Delta Catalog.



The above illustration shows how the controls of the lower guide are brought to the front of the table—at the operator's finger tips.

Some New Delta Features

This year Delta offers many new tools and features of interest including:

A remarkable NEW Belt Sander
Revolutionary NEW 17" Drill Presses
A NEW Precision 4" Jointer
A NEW Precision 11" Drill Press
A NEW 10" Band Saw
Improved 14" Drill Presses
Improved Combination Units
NEW Tapping Attachments
NEW Shaper Cutter-head
NEW Tenoning Collars
NEW Belt-Drive Buffer
NEW Belt Guards and Improved Safety Features

New Practical Instruction Books

Up-to-the-minute, carefully written, liberally illustrated with especially prepared photographs and diagrams, easy to understand and thoroughly practical.

MAKING MONEY with DELTA TOOLS
GETTING THE MOST OUT OF YOUR BAND SAW
GETTING THE MOST OUT OF YOUR SHAPER
GETTING THE MOST OUT OF YOUR LATHE
GETTING THE MOST OUT OF YOUR DRILL PRESS

No. 1. Making Money with Delta Tools—What to make, how to make it, where to sell it ..... 10c ☐

No. 2. Getting the Most Out of Your Shaper. A complete Shop manual of latest shaper practice with over 200 photographs and line drawings ..... 25c ☐

No. 3. Getting the Most Out of Your Band Saw. Full instructions for using band saw to best advantage ..... 25c ☐

No. 4. Getting the Most Out of Your Drill Press. Covering all phases of Drill Press operation ..... 25c ☐

No. 5. Getting the Most Out of Your Lathe. Covering wood turning, metal turning, metal spinning—over 200 photographs and line drawings ..... 25c ☐

HOW TO ORDER

Just clip this portion of the advertisement, check books desired, enclose proper remittance in coin or stamps and mail in with signed coupon.

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Find out how you can use Delta Tools to advantage in your school shops—how they save on initial investment, how they fit into the needs of practical vocational instructions. Learn what other schools are doing with Delta tools.

DELTA MANUFACTURING CO.
600-634 E. Vienna Ave., Milwaukee, Wis., Dept. E3C7

Please send me, without obligation, complete 1937 Delta Catalog together with any information available on the use of Delta Tools in the School field.

Name.....

Address.....

City..... State.....

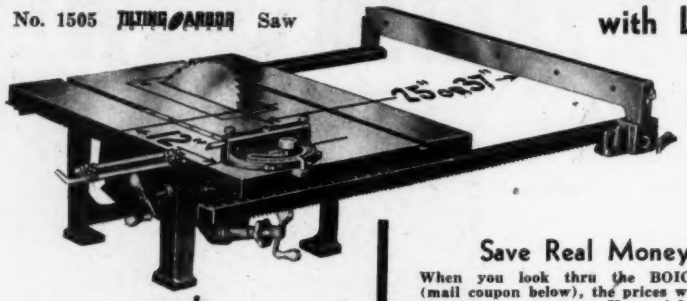
DELTA MFG. COMPANY

600-634 E. Vienna Avenue, MILWAUKEE, WIS.

IMPORTANT: Outside of Canada, United States and its possessions, Delta Tools are known as "Tauco" Tools. Tauco tools are identical in every respect to Delta Tools.

How To Make Shop Appropriations Buy More

with Latest 1937 BOICE-CRANE Machines



Is this your problem — to completely "machine" equip a wood shop or pattern shop on a low appropriation? It's no problem at all if you specify BOICE-CRANE Tools. Or, take the same amount you'd expect to spend for machines and by specifying BOICE-CRANE you can buy enough equipment to teach 50% more students.

Save Real Money Without Sacrificing Efficiency or Capacity

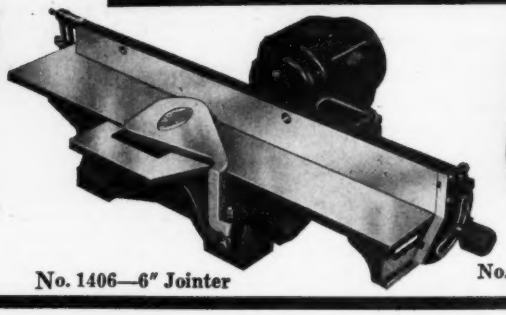
When you look thru the BOICE-CRANE catalog (mail coupon below), the prices will convince you we can save you money. You might then well ask—"but what of accuracy, capacity, conveniences, and up-to-date features? Would we sacrifice any of these, or could we still save money on our shop machines and get all these too?"
The truth is you couldn't buy greater accuracy in even larger tools at twice the price.

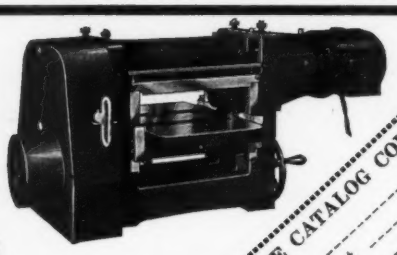
The capacity per tool is far greater than the average school shop will ever require, so you don't pay good money for cumbersome, space wasting, useless bulk and weight.
Every BOICE-CRANE Tool is provided with more useable operating conveniences and up-to-date features than you have ever hoped for. And as for safety—that is always FIRST in the designing of every BOICE-CRANE Tool.

BOICE - CRANE CO. DEPT. E-3 **Toledo, Ohio**

SAWS - BAND and JIG SAWS - JOINTERS - LATHES - PLANERS - SHAPERS - SANDERS - GRINDERS

No. 564 Shaper


No. 1406—6" Jointer


No. 1002—12"x4" Planer

FREE CATALOG COUPON (E-3)
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City
BOICE-CRANE CO. Toledo, Ohio

(Continued from page 20A)

criteria for reviewing the accomplishments of those who have taught for a period of time. The writer does not choose to attempt this differentiation. Obviously, the standards are an imaginative ideal — we make mental comparisons when we pass judgment.

Not all successful teachers possess each of the characteristics included in this topic. Each successful teacher probably has many of them. It is possibly more noticeable that those classed as teacher failures are usually deficient in other characteristics than scholarship. In other words, the successful individual is successful because he possesses or has developed certain superior characteristics.

In preparing this list of criteria no effort has been made to arrange them according to rank. There is so much of individual difference apparent that one cannot be positive as to the dominant teacher characteristics. The characteristics were arranged under three divisions: *specific, general,* and *professional.* Apparently this divisioning cannot be definite. The essential purpose has been to direct the reader's attention to the specific characteristics, but not without including for consideration those that are general and professional. At its best, the list is expected to serve only as criteria for partial judgment.

Specific Characteristics

Even in the more or less integrated school of the present each department has its peculiar problems and opportunities. The successful industrial-arts teacher must give due consideration both to the errors of the past — that he may profit by them, and to the needs of the future — that he may seek to anticipate and prepare for them. A carefully planned curriculum, with skillful teaching does produce "broad" individuals. This department's work requires good "working conditions" rather than good "study conditions" as in most academic classes. This list of criteria may also be used by the industrial-arts teacher as a self-checking device.

Since the industrial-arts instructor teaches more informally, pupil guidance is more natural and character education more effective. The work of this department needs to be considered as an essential portion of an integrated school program. Skillful teaching is an indispensable factor in securing these results. For a successful industrial-arts teacher, then, such characteristics as the following are necessary:

A. *Personal appearance* and *culture.* Well groomed — not fastidious. Well dressed for the work in hand.

B. *Manipulative skill* — able to work with his hands — practical minded. Efficient — possessed of "common sense."

C. *Teaching skill* — recognizes and takes advantage of individual differences. Regularly well-planned preparation and presentation, a progressive system applicable to local conditions.

D. *Initiative* — plans independently, yet co-operates with those charged with administration. Aggressive — constantly seeks methods that produce better results.

E. *Orderliness* — shop neatness, practical as a teaching device. Better working conditions, more economical, and makes a good impression.

F. *Industriousness* — most people soon recognize and respect the individual who "works at the job." Physically and mentally alert. A "leader" — not merely a "teller" or a "driver."

G. *Observant* — keen observer, quick to detect. Combines the ability to adapt and adopt the good ideas of others, and thus improves his teaching. Makes the best of his environment — resourceful.

H. *Diversified interests* — variety — including an appreciation of the beautiful. Interested in people and the problems of everyday life. Wide range of knowledge and interest — has a worth-while "hobby."

J. *Personality* — an engaging manner which usually attracts and seldom repels. Magnetic — forms "lasting" friendships in and out of school, commands respect, unselfish and gives due respect for others, discreet.

(Continued on page 38A)

Accuracy

Performance

Dependability

Sturdy . . . . .

Master Craftsmen

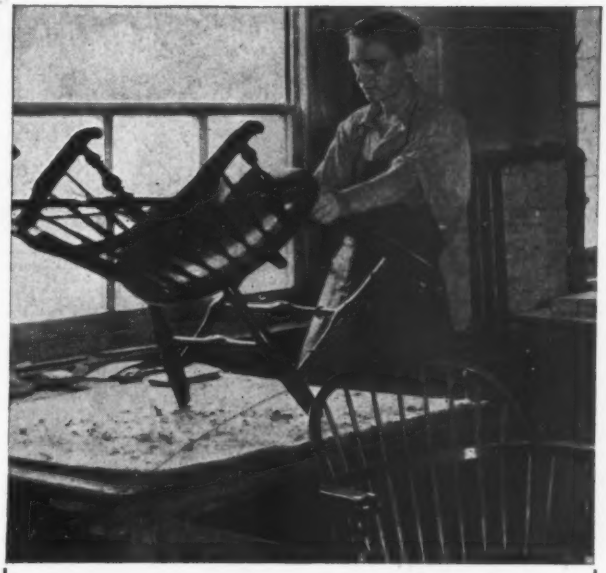
. . . are not made over night. Years of training and experience are necessary. You, the instructor, have the responsibility of developing the youth of today into the master craftsmen of tomorrow.

Specify Atkins Saws and Tools for your department. You will find them the right tools to instill confidence and develop the woodworking abilities of your students.

"It's a pleasure to work with fine tools."

ATKINS *Silver Steel* SAWS

A FAMILY OF CHAMPIONS



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Then give your boys a COMPLETE PICTURE of up-to-date factory practice and **PROVIDE INDUSTRIAL SANDPAPERS for YOUR FINISHING OPERATIONS**

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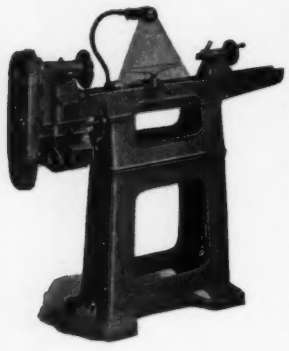
√ RUGGEDNESS

OVER 1500 SCHOOL INSTALLATIONS

WALLACE MULTI-SPEED LATHE



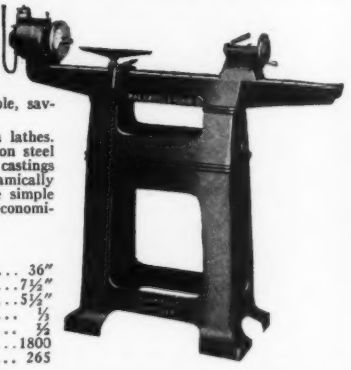
Here is a lathe built on a new principle. The headstock swivels so that large faceplate turning is done in front of the lathe. The cradle motor drive with non-slip flat belt transmits the power efficiently at every one of the nine speeds, uniformly graded from 550 r.p.m. to 2400 r.p.m.

Small in size, its advanced design gives unlimited capacity and versatility. Equipped with taper roller bearings, high carbon steel spindle, adjustable electric light, great variety of accessories. Low in price and maintenance cost, a safe, efficient and economical precision lathe.

SPECIFICATIONS

Capacity between centers, length	36″
Capacity over bed, dia.	7½″
Capacity with head swiveled, dia.	30″
Motor h.p. single phase a.c.	⅓
Motor h.p. three phase a.c.	½
Speeds, nine from 550 r.p.m. to	2400
Shipping weight with base and legs, lbs.	385

WALLACE SINGLE-SPEED LATHE



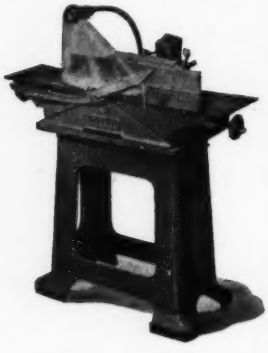
For turning work up to 6″ diam., this lathe with single-speed motor head gives the desirable speed of 1800 r.p.m. A convenient adjunct to the Wallace Multi-speed Lathe at an attractive low price. Furnished either floor or bench type, both portable, saving space and adding convenience.

Accessories are interchangeable on both lathes. Equipped with ball bearings, high carbon steel spindle, electric light, rugged iron castings give rigidity and long life. Motor dynamically balanced, no vibration, adjustments are simple and convenient — a safe, handy and economical lathe.

SPECIFICATIONS

Capacity between centers length	36″
Capacity over bed, dia.	7½″
Capacity over tool rest, dia.	5½″
Motor h.p. single phase a.c.	⅓
Motor h.p. three phase a.c.	½
Spindle speed r.p.m.	1800
Shipping wgt. with base and legs, lbs.	265

WALLACE DIRECT DRIVE JOINTERS



These precision jointers are offered with 6″ and 8″ knives, direct-drive at 3600 r.p.m. or gear drive at 5200 r.p.m. Dynamic balancing and accurate machining ensure smooth operation. Four knives set askew in 8″ cutterhead produces mirror-like surfaces. Available in both bench and floor models.

Equipped with ball and roller bearings throughout, high speed steel knives, adjustable electric light, heavy iron and semi-steel castings, rigid steel fence, quick action adjustments. New type guard more safe and convenient. These are powerful, durable and efficient jointers.

SPECIFICATIONS

	No. 10	No. 26
Length of knives	8″	6″
Number of knives	4	3
Length of tables	40″	30″
Cutter speed 3600 r.p.m. and	5200	5200
Motor h.p. single phase a.c., ½ and	1	1
Motor h.p. three phase a.c., 1 and	2	2
Shipping wgt., with stand, lbs.	420	360

WALLACE BELT-DRIVE JOINTERS

A new fast cutterhead speed of 4100 r.p.m. is obtained in this machine by the new cradled motor drive, with flat non-slip belt, saving wear and tear on motor and machine; and transforming all the power into useful work. Vibration eliminated by dynamic balancing.

Equipped with precision roller bearings, solid steel cutterhead, high speed steel knives, heavy iron and semi-steel castings, quick action adjustments, aluminum swinging guard. Available in bench or floor models with or without motor — a low-priced, high-speed jointer.

SPECIFICATIONS

Length of knives	6″
Number of knives	3
Length of tables	30″
Cutter head speed r.p.m.	4100
Motor h.p. single phase a.c. ¼ and	½
Motor h.p. three phase a.c. ¼ and	½
Shipping weight with stand, lbs.	260

WALLACE GEAR-DRIVE BAND SAW

An accurate dynamically balanced machine, ensuring smooth work, long blade life at the new high speed of 1100 r.p.m. Gear drive permits optional speeds for cutting metals and other refractory materials. Simple adjustments ensure fast and safe operation.

Equipped with ball bearings throughout, wheels completely guarded, built-in electric light, ball bearing saw guides, heavy pressed steel wheels. Wallace made bandsaw blades are twice as good as others. A husky compact production machine built for a life time of efficient service.

SPECIFICATIONS

Diameter of wheels	16″
Maximum space under guide	8″
Standard wheel speed r.p.m.	1100
Table size	19″ x 21″
Motor h.p. single phase a.c., ½ and	1
Motor h.p. three phase a.c., 1 and	2
Shipping weight, lbs.	500

WALLACE BELT-DRIVE BAND SAW

A new principle of cradled motor with non-slip flat belt drive transmits every ounce of power to the saw teeth, saves wear and tear on machine and blades. Two speeds, 1200 r.p.m. for wood, 600 r.p.m. for metal, just right for most efficient sawing. Dynamic balancing ensures smooth running.

Wheels cast aluminum, rubber tires ground true, precision roller bearings on wheels, ball bearing guide, built-in electric light, wheels fully guarded. Wallace made blades cut better and last longer than others. A very low priced and economical machine for heavy duty service.

SPECIFICATIONS

Diameter of wheels	14″
Maximum space under guide	6″
Standard wheel speeds, 600 r.p.m. and	1200
Table size	13″ x 19″
Motor h.p. single phase a.c., ¼ and	½
Motor h.p. three phase a.c., ¼ and	½
Shipping weight., lbs.	260

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ASK FOR

BLUE PRINTS OF MODEL SCHOOL SHOP LAYOUT . . .

Over 1500 school installations and over 75,000 industrial users furnish indisputable proof of the dependability and efficiency of Wallace Portable Wood Working Machines.

For your convenience we have prepared a model school shop layout. Blue print gladly sent upon request. Also send for condensed specifications, so they can be incorporated by you when calling for public bids.

Wallace PORTABLE MACHINES

WALLACE No. 8 UNIVERSAL SAW

The arbor tilts, — cuts made at any angle with table in horizontal position. Gear drive gives compact size, 2¾" cuts with 8" dia. blades, and 5200 r.p.m. spindle speed with standard motors. Dynamic balancing and efficient drive ensure fast, smooth and safe cutting.

Motor equipped with ball bearings, spindle with bronze bearings. Micrometer adjustment on rip fence, adjustable electric light and extension tables available. Three types of guard, dado heads, cope heads and cutters carried in stock. The finest universal saw money can buy.

SPECIFICATIONS

Size of saw blade, dia.	8"
Maximum depth of cut	2¾"
Size of steel table	25" x 25"
Width of rip or crosscut	12"
Motor h.p. single phase a.c., ½ and	1
Motor h.p. three phase a.c., 1 and	2
Shipping weight, lbs.	340

WALLACE OILSTONE GRINDER

A 3600 r.p.m. motor drives two cup grinding wheels with worm gearing. Oil is fed to cup wheels from large reservoirs through pipes. A dry grinding wheel and cone wheel are mounted on outer end of motor shaft. Silence and smooth running ensured by dynamic balance.

This machine is equipped with ball bearings throughout, steel table and tool holder are accurate and convenient. Suitable guards and convenient adjustments make its use safe and handy. A compact versatile grinder low in price and economical to operate.

SPECIFICATIONS

Size of cup wheels, 2" face by	6"
Space between cup wheels	8¼"
Speed of cup wheels r.p.m.	500
Speed of dry wheels r.p.m.	3600
Motor h.p. single phase a.c.	¼
Motor h.p. three phase a.c.	¼
Shipping weight, lbs.	225

WALLACE DIRECT-DRIVE SHAPER

A high speed motor integral with the shaper spindle gives an 8500 r.p.m. cutting speed. Dynamic balance eliminates vibration. Cutters from 3¼" diam. down to ¼" give versatility, and turn out mirror-smooth work. This machine is furnished in floor or bench models.

Ball bearing motor, air cooled, adjustable table, ingenious guard promotes safety, simple construction makes easy cutter set-up. Small diameter low cost cutters get in close corners. Standard cutters are stocked. Adjustable electric light is available.

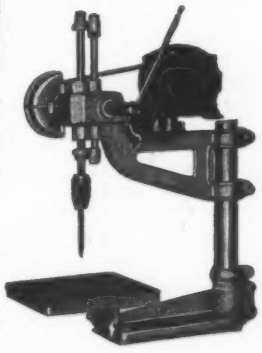
SPECIFICATIONS

	No. 18	No. 18F
Size of spindle diameter	⅝"	⅝"
Maximum width cutters	2¾"	2¾"
Maximum diameter cutters	3¼"	3¼"
Size of table	16"	20"x30"
Table adjustment	1½"	1½"
Motor h.p. single phase a.c.	1	1
Shipping weight, lbs.	85	240

WALLACE RADIAL DRILL

A simple, low-priced drill press with cradled motor belt drive for quick speed changes, and bevel gear drive to the spindle. The 13" throat capacity and swinging arm make this machine most versatile. Can be furnished in bench, wall and floor models.

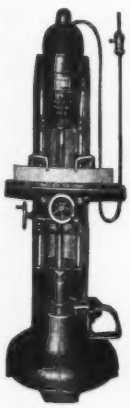
Equipped with ½" drill chuck, mortising attachment, 4 standard speeds, 4 extra speeds available — suitable for drilling metal up to ½" dia., or wood up to 1" dia. Column is heavy solid steel bar — not tubing. Castings all cast iron — no flimsy die castings. An efficient and trouble-free drill press.



SPECIFICATIONS

Chuck capacity, dia.	½"
Spindle travel	4¼"
Table size, square	10"
Spindle speeds 700 r.p.m. to	3350
Motor h.p. single phase a.c.	¼
Motor h.p. three phase a.c.	¼
Shipping weight, bench model, lbs.	84

WALLACE MORTISER



This compact, husky hollow chisel mortiser is built with all moving parts exactly centered with the slide rods, ensuring accurate and effortless operation. The motor is made with patented non-leaking bearings and dust cap which positively keeps oil and dust out. Stirrup type foot pedal is most convenient.

Equipment includes ¼", ⅜", and ½" hollow chisels and bits, and standard key type drill chuck which permits use of the machine as a drill press. Convenient clamps hold the work down, and large handwheels move table vertically and horizontally. A simple efficient and economical machine.

SPECIFICATIONS

Chisel size, maximum, ½" by	½"
Vertical travel of chisel	4"
Vertical adjustment of table	10"
Speed of boring bits r.p.m.	3600
Motor h.p. single phase a.c., ½ and	1
Motor h.p. three phase a.c., 1 and	2
Shipping weight, lbs.	465

WALLACE GLUE POT

This electric glue pot has a "click" type thermostat that snaps the current on and off when required to keep the glue temperature between 140° F. and 150° F. It is a "wet heat" glue pot with sealed-in water container. Glue cannot burn in this glue pot, and is always ready for use.

Equipped with metal-sheathed heating element, Westinghouse "click" thermostat, asbestos cord separable at the pot. The body is heavy cast aluminum, the glue container a sheet copper stamping. Brush wiper and screws of monel metal. Assembly designed for quick and easy inspection or servicing.

SPECIFICATIONS

Glue capacity, quarts	2
Glue temperature, 140° F. to	150° F.
Water bath capacity, pints	3
Heating element, watts	650
Height of pot	8"
Diameter of pot	8½"
Shipping weight, lbs.	11

J. D. WALLACE & CO. 140 S. CALIFORNIA AVE. CHICAGO . . ILLINOIS

Metal-Working Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Air Compressors — for machine shop, foundry, or forge shop
Anvil — 100-lb.
Arbor Press — bench or pedestal type
Barrows
- *a*) Coke
- *b*) Foundry
- *c*) Scrap

Belt Lacer
Benches
- *a*) Coremaking
- *b*) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- *c*) Molding

Blackboard — permanent or portable
Blowers — for furnaces, forges, etc.
Blowtorch — 1 qt. size
Bookcase — for reference books, catalogs, etc.
Boring Bar
Boring Mill — vertical or horizontal
Bulletin Board
Cabinets — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
Casehardening Boxes
Centering Machine
Chain Hoists — differential, duplex or triplex
Chairs — teacher's and tablet-arm, if needed for related-subjects room, or for demonstration section
Chuck
- *a*) Drill, selected sizes
- *b*) Lathe, combination, 4-jaw, selected sizes
- *c*) Lathe, independent, 4-jaw, selected sizes
- *d*) Lathe, universal 3-jaw, selected sizes
- *e*) Milling machine, universal

Core Oven — for foundry
Cranes and Hoists — air, electric or hand, of the jib, traveling, or portable type
Cupola — for foundry, coke, or electric, ¼ to 1-ton capacity
Desk — teacher's, with drawer compartments
Die-Filing Machine
Dividing Head
Drills
- *a*) Bench, hand
- *b*) Breast
- *c*) Electric, portable
- *d*) Hand
- *e*) Post, hand or power
- *f*) Radial
- *g*) Sensitive
- *h*) Upright, power

Flasks — 2 or 3 part, steel or snap type
Forge — coal or gas, with hand or electric-driven blower
Furnaces
- *a*) Annealing
- *b*) Bench
- *c*) Brass and soft metal
- *d*) Combination bench
- *e*) Casehardening
- *f*) Cyanide
- *g*) Gasoline
- *h*) Heat treating
- *j*) Melting

Gear-Cutting Machine
Grinder
- *a*) Bench, hand or power driven
- *b*) Combination grinder, buffer and polisher
- *c*) Emery, bench or pedestal type
- *d*) Face, with magnetic chuck
- *e*) Portable tool post
- *f*) Precision, for external and internal grinding
- *g*) Universal tool cutter, drill and reamer grinder
- *h*) Wet tool

Hack Saw — motor or belt driven
Hand Picks — for cleaning inside of cupola, 1¼ to 2½ lb.
Hardness Testing Machine
Lathes — belt or individual drives
- *a*) Automatic
- *b*) Bench, 6 in. to 11 in. swing, 11 in. to 36 in. between centers
- *c*) Change gear, 9 in. to 14 in. swing, 18 in. to 36 in. between centers
- *d*) Quick-change gear, 9 in. to 16 in. swing, 18 in. to 36 in. between centers
- *e*) Semiquick-change gear, 9 in. to 18 in. swing, 18 in. to 42 in. between centers
- *f*) Turret
- *g*) Metal spinning

Milling Machine
- *a*) Plain, cone or motor-driven type
- *b*) Universal, cone or motor-driven type

Nibbling Machine
Pipe Cutter
Planer — belt or motor driven
Power Hammer — for forging operations
Punches — metal, hand, or power
Pyrometer
Pyroscope
Relieving Attachment for Lathe
Sand Sifter — for foundry, hand or power
Sandblast Outfit — with cabinet
Scale
- *a*) Counter for machine shop
- *b*) Platform, for foundry, 1000-lb. capacity

Shaper
Slotter
Snap-Flask Jackets — to fit snap flasks used
Straightening Press
Surface Plates
Swage Block and Stand — for forge shop
Taper Attachment for Lathe
Truck — warehouse
Tumbling Barrel — for foundry
Vises
- *a*) Blacksmith
- *b*) Drill press
- *c*) Machinist
- *d*) Pipe
- *e*) Planer
- *f*) Shaper

Welding Outfit
- *a*) Acetylene
- *b*) Electric

Metal Working—Small Tools

Arbors
- *a*) Drill chuck to suit requirements
- *b*) Reamers, various sizes
- *c*) Shell tool, various sizes
- *d*) Straight shank for shell reamers and shell drills, selected sizes
- *e*) Taper shank for shell reamers and shell drills, selected sizes

Bearing Scraper
Bellows — for foundry class
Bevel Protractor
Brooms and Floor Brushes — for shop and foundry
Brushes
- *a*) Bench
- *b*) Core box
- *c*) Core painting
- *d*) Hard brushes for foundry
- *e*) Floor
- *f*) Soft brushes for foundry

Bulb Sponges — for molders
Draw Pins — for molders
Calipers
- *a*) Hermaphrodite, 4 in. and 6 in.
- *b*) Inside, 4 in. and 6 in.
- *c*) Outside, 4 in. and 6 in.

Cans
- *a*) Oil, 1/3-pt., 1-pt., and 10-gal.
- *b*) Waste

Center Testers
Chisels
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 5/8 in. and ¾ in.
- *c*) Diamond point, 3/8 in. and ½ in.
- *d*) Round nose, 3/8 in. and ½ in.

Clamps
- *a*) 4 in., 6 in., 8 in., and 10 in.
- *b*) Flask, for foundry
- *c*) Strap, various sizes

Coke Forks — for foundry
Collets
- *a*) For milling machine, selected sizes
- *b*) For lathe, selected sizes

Combination Squares — with hardened head and blade, and protractor head, 9 in. and 12 in.
Counterbores — straight and tapered shanks, selected sizes
Countersinks — for metal
Crucible Tongs — to fit crucibles
Crucibles — selected sizes
- *a*) Shanks, single-end to fit ladles
- *b*) Shanks, hand, to fit ladle bowls

Cutters — angular-milling, bevel-gear, concave-milling, convex-milling, end-milling, face-milling, formed-milling, grooving, involute gear teeth, key-seat, side-milling, and metal-slitting
Dividers — Spring, 4 in. and 6 in.

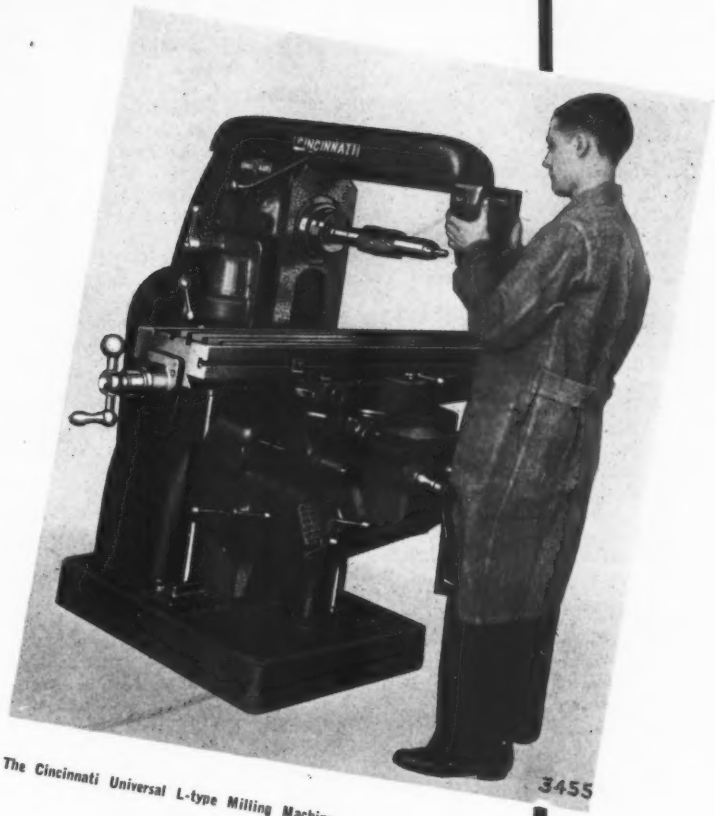
(Continued on page 28A)

CINCINNATI

A SYMBOL OF A DEFINITE STANDARD OF WORTH

SIMPLICITY . . .

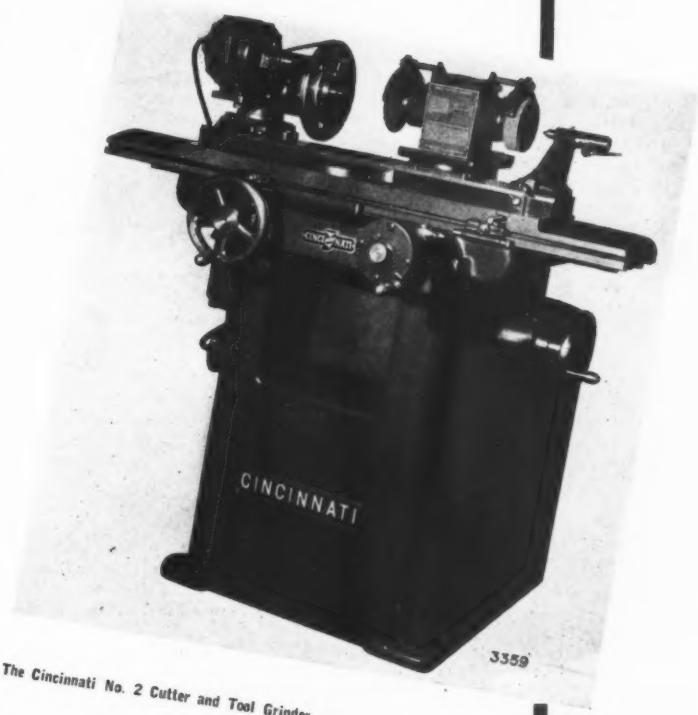
Just the right size for vocational students. Big-machine features and safety devices. That's what you see when you look at the Cincinnati L-type, picture dat the right. The lad engaged in setting up the machine, himself an apprentice, is obviously of slight build. Notice how easy it is for him to place the arbor support on the overarm. No chance of straining young muscles. And the many safety devices compensate for his inexperience. Consider these advantageous features: power feed and rapid traverse to longitudinal, cross, and vertical movements; convenient and easy speed and feed changes; overload safety clutch; spring release hand cranks.



The Cincinnati Universal L-type Milling Machine

Correctly sharpened cutters . . . the supporting factor of efficient milling practice. Notice the convenient operating features of the Cincinnati Cutter and Tool Grinder, making the best results easier to produce. A touch of the finger moves the table along its anti-friction ways. Clearance setting dials are large and direct reading. Duplicate controls promote equal simplicity, for sharpening right hand or left hand cutters.

How lucky the lad who learns on the same machines he will find in hundreds of shops after graduation.



The Cincinnati No. 2 Cutter and Tool Grinder

Upon receipt of a request on your letterhead, we will send you, at a price of only 35 cents, our regular 64 page operator's instruction book for the Cutter Grinder illustrated here. We will send you, at no charge, an attractive circular on the L-type Milling Machine, or a booklet describing our training school, upon receipt of your letterhead request.

PRODUCTS

Knee type and fixed bed milling machines
Centertype grinding machines
Centerless grinding machines
Cutter sharpening machines
Surface broaching machines
Centerless lapping machines

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO, U. S. A.

(Continued from page 26A)

Drill
- *a*) Drifts, different sizes
- *b*) Drill sleeves, different sizes
- *c*) Stand for Nos. 1 to 60
- *d*) Stand for 1/16 in. to ½ in. by 64ths

Drills
- *a*) Center
- *b*) High-speed, taper shank, various sizes
- *c*) Jobbers, straight shank, 1/16 in. to ½ in. by 64ths
- *d*) Ratchet
- *e*) Straight shank, Nos. 1 to 60
- *f*) Taper shank, ½ in. to 1 in. by 16ths

Emery — rubstones for cleaning castings in foundry

File Cards

Files
- *a*) Die sinkers, various shapes
- *b*) Flat bastard, 8 in. and 10 in.
- *c*) Half-round, double cut, 6 in., 8 in., and 10 in.
- *d*) Hand, smooth, 8 in. and 10 in.
- *e*) Mill, smooth, 8 in. and 10 in.
- *f*) Round bastard, 8 in.
- *g*) Square bastard, 8 in.
- *h*) Swiss, various shapes
- *j*) Three-square, double cut, 6 in.
- *k*) Warding, double cut, 6 in.

First-Aid Cabinet and Supplies

Forge Tools — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop

Gate Sticks — maple, for foundry

Gauges
- *a*) Center
- *b*) Depth
- *c*) Drill and wire
- *d*) Screw pitch, select kinds
- *e*) Surface

Gloves — asbestos, for foundry

Goggles
- *a*) For machine shop
- *b*) For foundry

Hack Saw
- *a*) Blades, hand, 18T, 10 in.
- *b*) Blades, power, 14T, 12 in.
- *c*) Frames, adjustable

Hammers
- *a*) Babbitt
- *b*) Ball-peen, 13-, 16-, or 20-oz.
- *c*) Blacksmith's, various kinds
- *d*) Riveting, 9- and 12-oz.
- *e*) Setting

Indicator
- *a*) Center
- *b*) Universal or universal dial test
- *c*) Speed

Knurling Tool — with assorted knurls

Ladles
- *a*) Bull
- *b*) Hand bowls
- *c*) Melting

Lathe Dogs — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

Leggins — fireproofed duck, to protect students when pouring in foundry

Level — 6 in. bench

Lifting Screws — for molders

Mallets — wood or soft

Mandrels — selected sizes

Micrometers — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.

Molding Boards

Molding Sticks and Trowels — various kinds

Nippers — end-cutting, 5 in.

Oil Storage Tank — with pump

Oilstones — medium and fine

Pails — galvanized, 12-qt. capacity for foundry

Parallels
- *a*) Adjustable
- *b*) Steel, assorted sizes

Pliers
- *a*) Combination, 6 in.
- *b*) Side-cutting, 6 in.

Punches
- *a*) Center, ¼ in. and ⅜ in.
- *b*) Hollow, ½ in., ¾ in., and 1 in.
- *c*) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
- *d*) Prick, ¼ in.

Rammers — for foundry
- *a*) Hand
- *b*) Floor

Reamers — various sizes
- *a*) Adjustable
- *b*) Hand
- *c*) Taper pin
- *d*) With taper shank

Riddles — ¼ in. and ⅛ in. mesh, 18 in. diameter, for foundry

Rivet Sets — assorted sizes

Scales
- *a*) Steel, 6 in., graduated 1/64 in. to ⅛ in.
- *b*) Steel, 12 in., graduated to 32nds

Screw Drivers — 6 in. and 9 in. blade

Scribers

Shovels
- *a*) Coke
- *b*) Sand

Snips — tin, 3 in. straight and 3 in. curved

Sockets — for taper shanks, drill and tools, selected sizes

Soldering Coppers and Handles — 1-lb. size

Spray Can — for molders

Sprinkling Cans — galvanized iron, 16-qt. capacity, for foundry

Sprue Picks — for molders

Squares
- *a*) Machinists', 6 in.
- *b*) Blacksmith's

Steel Figures, ⅛ in.

Steel Letters — ⅛ in.

Swabs — for molders

Tapeline — steel, 25 ft.

Taps and Dies
- *a*) Machine screws
- *b*) Pipe
- *c*) S.A.E. ¼ in. to ¾ in.
- *d*) U.S.S. ¼ in. to ¾ in.

Tongs
- *a*) Blacksmith's, various kinds
- *b*) Pick-up, for foundry
- *c*) Shake-out, for foundry

Tool Holders
- *a*) Boring tools
- *b*) Cutting-off tools
- *c*) Planer
- *d*) R.H. and L.H. offset shank
- *e*) Shaper
- *f*) Slotter
- *g*) Straight shank
- *h*) Threading

Tool-Holder Bits — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.

Trammel Points

V Blocks and Clamps

Wheel Dresser

Wrenches
- *a*) Adjustable, 8 in. and 10 in.
- *b*) Pipe, 8 in. and 12 in.
- *c*) Tap, adjustable, various sizes

Metal Working—Materials and Supplies

Abrasive Wheels

Acetylene Gas — in drums for welding

Aluminum
- *a*) Pigs for foundry
- *b*) Sheets, tubing, rounds, shapes, wire, etc.

Babbitt Metal

Bearing Blue

Belt Dressing

Belt Lacing Material

Belt Leather

Bolts
- *a*) Carriage, selected sizes
- *b*) Lag, selected sizes
- *c*) Machine, selected sizes
- *d*) S.A.E., selected sizes
- *e*) Stove, flat or round heads, selected sizes

Brass
- *a*) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
- *b*) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
- *c*) Sheets, 28 to 32 American gauge, 12 in. wide x 72 in. to 84 in. long, selected sizes
- *d*) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
- *e*) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
- *f*) Wire, soft, 8, 11, and 14 American gauge, selected sizes
- *g*) Wire, spring, 8 to 22 American gauge, selected sizes

Casehardening Compounds

Chaplets — single and double head

Coal
- *a*) Charcoal for foundry or forge
- *b*) Coke for foundry
- *c*) Forge

Copper
- *a*) Pigs, for casting alloys
- *b*) Sheets, 8 to 25 American gauge, 30 in. x 60 in., selected sizes
- *c*) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
- *d*) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼-, ½-, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

Core
- *a*) Compounds
- *b*) Flour
- *c*) Paste
- *d*) Oil
- *e*) Wax-vent wire

Cutting Compounds

Emery Paper and Cloth — Nos. 00, 0, ½, 1, obtainable in sheets or rolls, selected sizes

Fire Bricks and Clay — for foundry

Fire Handles — assorted sizes

(Continued on page 32A)

Longer Time Between Resharpenings

The shop instructor who must keep his entire stock of tools in shape will welcome cutting tools bearing the name of Morse. Because "there is a difference", Morse Tools have earned for themselves the reputation of stretching time between resharpening. Morse Tools do not require constant attention to turn out good work, in the hands of the student or the skilled mechanic.

MORSE TOOLS
FOR THE SCHOOL SHOP

(*above*)
No. 302 Taper Shank Drill. Made of carbon steel, for use in all types of power drilling not requiring high speed steel.

No. 330 Straight Shank Drill. So called "Jobbers" drill of carbon steel for use in all types of hand drilling.

(*above*)
No. 602 Hand Reamer. Carbon steel, spiral fluted reamer, ideal for hand use in the school shop.

No. 717 Expansion Reamer. Because of its expansion feature, very useful in the school shop. ¼" to 2" diameter.

No. 1045 Spiral Pointed Hand Tap. Satisfactory for machine tapping of most materials in through holes. Furnished in plug style only.

No. 1184 Adjustable Round Die. Supplied in all sizes and threads, for hand thread cutting of commonly used metals.

Send For Your Copy Of The Morse Catalog — Use It As Your Guide To Good Tools

MORSE TOOLS FOR THE ADVANCED OR AUTOMOTIVE SHOP

No. 1302 High Speed Taper Shank Drills. Built for steady production work in power drilling machines. Supplied in all sizes, from ⅛" to 3" diameter.

(*above*)
No. 1683 High Speed Taper Pin Reamer. Helical Flutes. Taper ¼" per foot. Indispensable in any machine or automotive work where taper pins are used.

No. 1728 High Speed Adjustable Reamer. Six tapered blades that slide lengthwise in the body slots and are firmly held in the position that gives the desired diameter.

No. 495 Combined Drills and Countersinks. Made of carbon steel, in all popular sizes and types. Useful for drilling and countersinking center holes, or for starting holes at an angle.

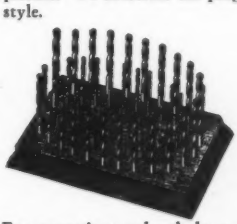
No. 773 Screw Extractor. Very useful for removing pieces of studs, bolts or screws from holes in which they have been broken off.

No. 1805 Heavy Duty End Mill. (*above*) Coarse tooth, spiral type, for heavy milling. Regularly furnished either right or left hand.

No. 1809 Alternate Tooth Milling Cutter. (*right*) For deep slotting in tough metals. Alternate teeth provide a shearing cut and ample chip clearance.

No. 1040 Hand Tap. Furnished in popular sizes and pitches. We illustrate the plug style.

No. 1145 Tap Wrench. Furnished in sizes 0 and 1, will handle all taps from 1/16" to 5/16", reamers from ⅛" to 15/32".



For convenient and orderly arrangement of drills, a Morse Drill Block (*above*) or Drill Case (*right*) will be found ideal for the school shop.

MORSE THERE IS A *DIFFERENCE* TWIST DRILL & MACHINE COMPANY NEW BEDFORD - - - MASS., U. S. A.

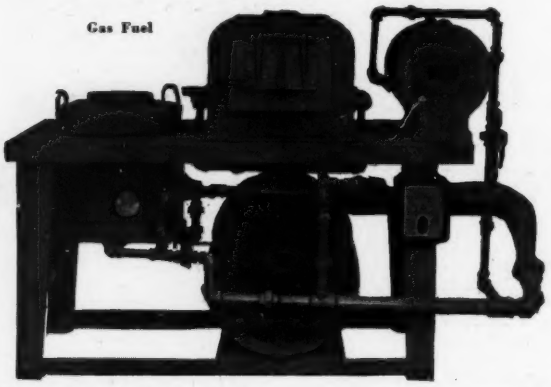
THE MORSE LINE INCLUDES HIGH SPEED AND CARBON DRILLS - REAMERS - CUTTERS - TAPS and DIES - SCREW PLATES - ARBORS - CHUCKS - COUNTERBORES - MANDRELS - TAPER PINS - SOCKETS - SLEEVES

FURNACES STEWART FORGES

The furnaces and combinations here shown are just several of a variety designed and developed for the school shop

Stewart Triple Purpose Furnaces

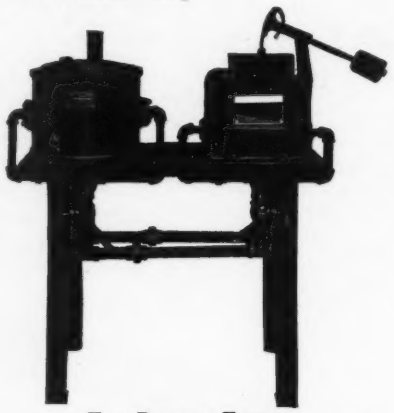
Gas Fuel



These series of combination furnaces are compact and very popular for educational purposes—an assembly of three types of our Stewart Standard Furnaces

Crucible Section
Oven Section
Forge or High Speed Section

These units make a complete plant covering practically the whole range of heat treating. Write for particulars.



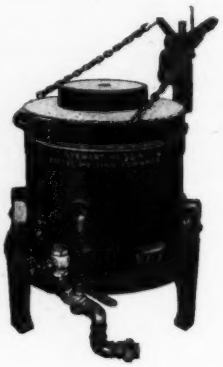
Two Purpose Furnace

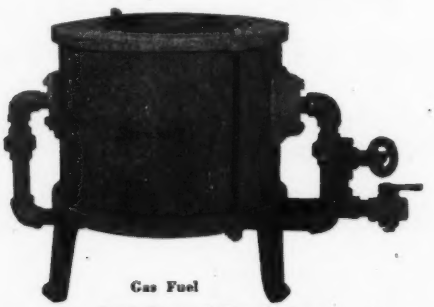
Excellent for lead hardening or other liquid heat hardening. Can be used for melting soft metals. Is fitted with Stewart pressed steel pot 6″ diameter x 6″ deep or 6″ diameter x 8″ deep.

No. 12A Metal Melting Furnace

A sturdy efficient melting furnace having a capacity of 36 lbs. Brass, is fitted with a No. 12 Graphite crucible and lined with first quality refractories. Swinging top made of one piece of molded refractory, banded to add strength, lifts easily from body by means of a special mechanism which swings cover to one side, giving a clear opening into body of furnace.

Floor space.....24″ x 24″
Shipping weight.....435 lbs.





Gas Fuel

No. B68 Round Pot Furnace

This bench type unit is equipped with a 6″ diameter x 8″ deep pressed steel pot for lead or salt hardening. Can also be used for oil tempering. Lined with heavy refractories and fired so that no flame strikes the pot direct.

Height .....19″
Bench space .....20″x24″
Shipping weight .....170 lbs.

No. 4A Bench Metal Melting Furnace

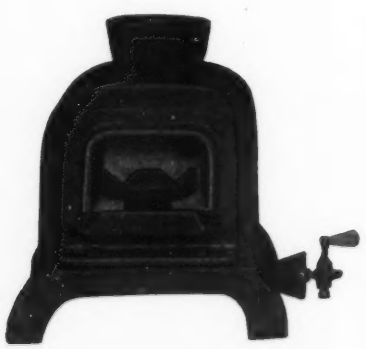
This melter is fitted with a No. 4 Graphite crucible, lined with heavy firebrick and fitted with a swinging cover for the melting of brass, copper, and aluminum. Fast, quick heats assured.

Height .....19″
Bench space .....20″ x 24″
Shipping weight .....180 lbs.

No. B40 Bench Soft Metal Melting Furnace

Although small in size, this unit has a capacity of 40 lbs. of lead. Suitable for the melting of any soft metals. Cast Iron shell, lined with insulation, and fitted with a cast iron pot with handle for removing and pouring.

Atmospheric Burner.
Pot.....6″ diameter x 5″ deep
Bench space.....12″ x 20″
Height .....10″
Shipping weight .....55 lbs.



No. 2M Combination Soldering Iron Heater and Melting Pot

A very compact, sturdy and efficient gas heater for Soldering Irons. The flame is projected upward from the bottom and surrounds the irons, heating them rapidly and uniformly. Heavy cast iron body, lined with heavy firebrick. Retains the heat and does not burn out.
Pot on top for melting soft metals.
Will accommodate two 4-lb. irons.

Floor space.....16″ x 11″
Atmospheric or blast burners
Shipping weight.....100 lbs.

No. 152 Forge
Ideal for Small Work

This unit is very handy and one that can be placed conveniently on a bench or small table for the heating of small pieces to be forged, for the heating of rods for bending, for tool dressing, and for the taking of end heats. It has a small opening at both ends so that center heats can be taken or it can be worked from both ends. Ideal where a quick intense heat is required. The top is removable so that a wide variety of work can be handled.

Entrance.....1¼" x 1¼"
Bench space.....12" x 12"
Overall height .....15"
Shipping weight.....60 lbs.

There is a Stewart Furnace for every heat treating requirement.

Ask us for your copy of our Stewart wall chart of S.A.E. steel specification.

SK 248 Forge

A well built forge designed for tool dressing, rod end work, heating for bending, welding, the taking of center heats, and many other purposes where a fast high heat is required. Fitted with air curtain in front to protect the operator and equipped with a proportional gas and air mixer and a quenching tank with rack for tongs.

Opening .....4" wide x 2" high
Heating depth .....8"
Rear opening.....3" diameter
Shipping weight.....450 lbs.

Stewart Standard Ovens

Indirect heat and equipped with a U-shaped hearth slab so that no flame comes in a direct contact with the work. Will handle a wide variety of work, such as annealing, carburizing, tool and die hardening, and general heat treating suitable for temperatures up to 2000 deg. Fahr.

STANDARD SIZES

5" wide x 9" high x 13½" deep
and larger

No. 51 Bench High Speed Oven

This small under-fired furnace signed for high speed steel hardening where quick, high heats are essential has a carbofrax U-shaped hearth and no flame can strike the work direct. Suitable for temperatures of 2450 deg. Fahr. Built of Stewart quality throughout.

Opening .....3" high x 5" wide
Heating depth .....6"
Bench space.....20" x 13"
Shipping weight.....200 lbs.

Stewart No. 28 Bench Oven

Here is a very handy furnace for general shop work, lined with heavy first quality refractories and of the under-fired type, for the heat treatment of carbon and high speed steel. Fitted with U-shaped hearth. Adapted to annealing, carburizing, tool and die hardening, and general heat treating.

Opening.....4" high x 8" wide
Heating depth .....12"
Bench space.....24" x 24"
Shipping weight .....550 lbs.

Accredited Representatives and Dealers

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11 West 42nd St.
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Brammer Machine & Tool Service Co.
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C. H. Gosiger Machy. Co.
Bacon and McConough Sts.
Dayton, Ohio

H. A. Smith Machy. Co.
Syracuse, New York

Galvin Machy. Sales
500 Brisbane Building
Buffalo, New York

W. W. Wentz
113 Powers Bldg.
Rochester, New York

Chandler Mach. Co.
286 Pryor St., S.W.
Atlanta, Georgia

For complete specifications and catalogs, write

CHICAGO FLEXIBLE SHAFT COMPANY, 5529 W. Roosevelt Road Chicago, Illinois

Stewart Industrial Furnace Division

HOW TO USE A MICROMETER

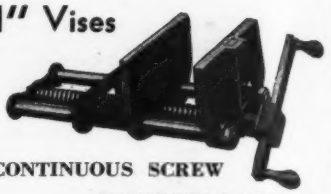
Complete instructions on how to use a micrometer is one of the subjects covered in the Starrett Educational Set. Other pages tell the uses of combination squares, depth gages, inside micrometers, surface gages, vernier calipers and eight other important tools. The 14 pages are furnished in blue print form in standard 8" x 10½" size, punched to fit a student's notebook. Furnished to students and instructors at cost—10 cents per set.

THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
Athol, Mass., U.S.A.

Use Starrett Tools

Specify "MORGAN" Vises

They don't cost any more. Are unsurpassed for strength, rigidity and durability. Guaranteed against breakage. Any part broken in service replaced free of charge. When through wear it becomes necessary to replace parts, this is easily accomplished because special machining allows interchangeability of all parts.



CONTINUOUS SCREW

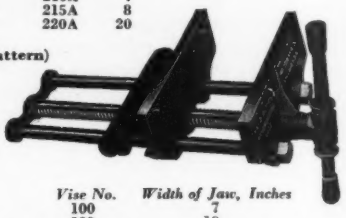
PARALLEL BAR VISE

Adjustable Steel Handle—Stop in Front Jaw
Wood Handle Furnished if Desired. Furnished with or without stop in front jaw. Faces drilled for installation of wood faces.

Vise No.	*Width of Jaw, Inches*
210A	7
215A	8
220A	20

QUICK ACTION VISE (Toles Pattern)

Has unusually effective and durable working action. Screw is 1¼" in diameter. Half nut of high quality bronze with accurately cut threads. Furnished with or without dogs in front jaw.



Vise No.	*Width of Jaw, Inches*
100	7
200	10

MACHINISTS' VISES
Unsurpassed for strength and durability

Swivel Base Machinist's Vise

Stationary Base		Swivel Base	
Vise No.	*Width of Jaws Inches*	*Vise No.*	*Width of Jaws Inches*
30	3	130	3
35	3½	135	3½
40	4	140	4
45	4½	145	4½
50	5	150	5

We will gladly quote on your requirements or send illustrative material upon your suggestion to do so

MORGAN VISE CO.
120 N. Jefferson Street Chicago, Ill.

(Continued from page 28A)

Graphite — for foundry
Iron — Pig, for foundry
Lacquer — transparent and colored, for finishing
Nuts — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds
Oil
- *a*) Boiled linseed
- *b*) Lubricating
- *c*) Quenching and hardening

Packing
Round, sheet, square, or tubular
Paint — black asphaltum
Pins
- *a*) Cotter, 3/32 in. to ¼ in. diam. from ½ in. to 2 in. long
- *b*) Flask, for flask repairs
- *c*) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

Pumice Powder
Rivets
- *a*) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
- *b*) Iron, No. 14 gauge to 3/16 in., flat-head or button-head, ¼ in. to 1 in. long, selected sizes
- *c*) Tinners', flat-head, 8-oz. to 16-lb., either tinned or black, selected sizes

Sand
- *a*) Molding, in 350-lb. barrels or 800-lb. casks
- *b*) Parting, in 350-lb. barrels or 800-lb. casks

Screws
- *a*) Flat-head or round-head iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds
- *c*) Set, head and headless

Solder — acid or rosin core; bar, or solid wire
Soldering Paste or Salts
Steel
- *a*) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4 ft. lengths, selected sizes
- *b*) Bars, cold-rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12 ft. lengths, selected sizes
- *c*) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3 ft. lengths, selected sizes
- *d*) Rods, hexagon and square, cold-rolled, ¼ in. to ¾ in., in 12 ft. lengths, selected sizes
- *e*) Round, cold-rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
- *f*) Sheet, black, Nos. 18, 20, 22, 24, 26, 28 U.S. gauge; size of sheets, 24 in., 28 in., and 30 in. x 96 in.
- *g*) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U.S. gauge; size of sheets, 24 in., 28 in., and 30 in. x 96 in., selected sizes
- *h*) Threaded rods, Nos. 6 to 10, in 12 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes

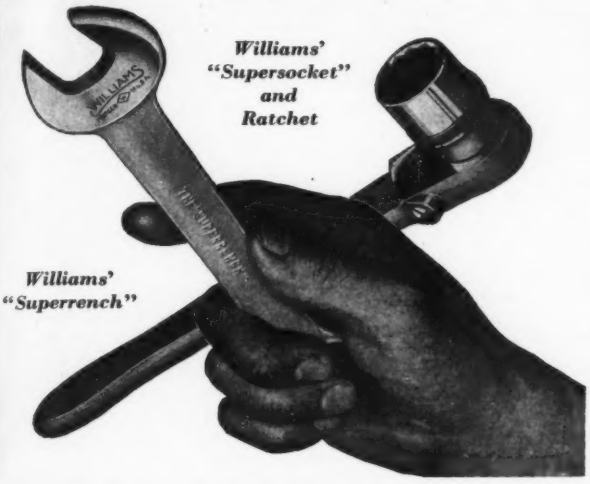
Tin
- *a*) Pigs, for casting alloys
- *b*) 1C, 1X, 20 in. x 48 in.
- *c*) 1XX, 20 in. x 48 in.

Washers and Burrs
- *a*) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
- *b*) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
- *c*) Brass washers, 3/16 in. to ½ in. by 16ths
- *d*) Iron washers, 3/16 in. to ½ in. by 16ths

Welding Fluxes
Welding Rods (all rods come in 24 in. lengths)
- *a*) Brazing, 1/16 in., ⅛ in., and 3/16 in. diameter
- *b*) Cast aluminum, 3/16 in., ¼ in., and ⅜ in. diameter
- *c*) Cast brass, 3/16 in., and ⅜ in. diameter
- *d*) Cast bronze, ¼ in. diameter
- *e*) Cast copper, 3/16 in. and ¼ in. diameter
- *f*) Cast iron, 3/16 in., ¼ in., 5/16 in., and ⅜ in. diameter
- *g*) Low carbon steel, ⅛ in., 3/16 in., and ¼ in. diameter

White Lead — for machine shop
Wire
- *a*) Annealed, 16 to 34 English gauge, selected sizes
- *b*) Coppered market, 5 to 18 English gauge, selected sizes
- *c*) Coppered spring, 2 to 18 English gauge, selected sizes
- *d*) Galvanized, 5 to 18 English gauge, selected sizes
- *e*) Piano, Nos. 00 to 36, selected sizes
- *f*) Tinned, 16 to 24 English gauge, selected sizes
- *g*) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

Zinc
- *a*) Pigs, for casting alloys
- *b*) Sheet, Nos. 4 to 14, sheets 36 in. x 84 in.



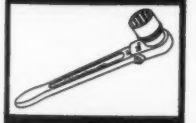
THESE WRENCHES HAVE "GONE TO SCHOOL" FOR 50 YEARS

DROP-FORGED WRENCHES
Carbon and Alloy

LATHE DOGS

TOOL HOLDERS
ALL PATTERNS

"C" CLAMPS


DETACHABLE SOCKET WRENCHES

and other DROP-FORGED SPECIALTIES

All industry depends on Williams' Wrenches, backed by fifty years of designing and drop-forging experience. Equip your school shop with the tools that industry uses and approves.

WILLIAMS' "SUPERRENCHES"

Drop-forged from chrome-molybdenum steel, scientifically heat-treated for maximum tough strength and chrome-plated. Their thin heads and pointed jaws get in and *grip*—they deliver the goods, without wasting time. Admittedly the finest wrenches of their kind, no school shop should be without them.

WILLIAMS' "SUPERSOCKET" WRENCHES

are famous for dependable, lightning-fast action. Heat-treated and chrome-plated, they feature thin socket walls for cramped quarters plus extraordinary strength. Five patterns, with a complete assortment of handles and parts. Sold individually and in handy Sets.

* * *

Write for Williams' Catalog "E" of fully guaranteed tools and shop specialties. Buy them from mill supply and industrial goods distributors.

J. H. WILLIAMS & CO.
75 Spring St., New York.

Headquarters for: Drop-Forged Wrenches, (Carbon and Alloy) Detachable Socket Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts, Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs and Vises, etc., etc.

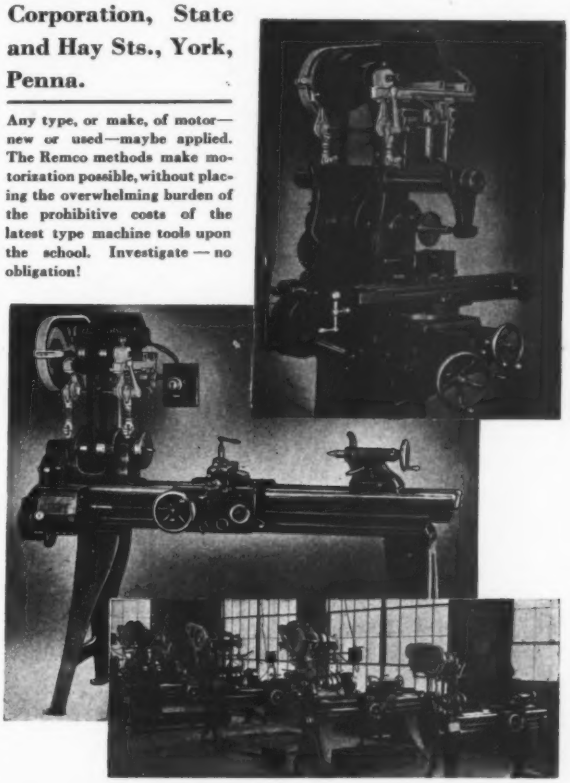
WILLIAMS
SUPERIOR DROP-FORGED TOOLS

MOTORIZE...
. . . . at very low cost

One school director purchased seven pieces of machine tool equipment, motorized them the Remco-way, at a cost—for motors, and all—that was less than the price of a new milling machine.

The low cost of a Remco installation will surprise you. Remco's power savings will please your Board. Enable you to train your students the modern way. Eliminate costly maintenance of overhead shafting, pulleys, clutches and belting, etc. Increase safety! Improve lighting! Reduce noise! Specify Remco Drives! The only motor drive changeable from one tool to another—not built special. Get details—installation estimates—no obligation! Write for FREE folder—"Saving Money for Vocational Schools." Manley Products Corporation, State and Hay Sts., York, Penna.

Any type, or make, of motor—new or used—maybe applied. The Remco methods make motorization possible, without placing the overwhelming burden of the prohibitive costs of the latest type machine tools upon the school. Investigate — no obligation!



REMCO
MOTOR DRIVES

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Air Compressor
- *a)* 3 to 4 cu. ft., with tank, piping, and motor
- *b)* Small portable, 1 cu. ft., with motor

Aligning Jig — for connecting rods
Anvil
- *a)* No. 100 or No. 125
- *b)* Rim

Armature Growler and Tester
Axle Stands
Battery Equipment
- *a)* Cell tester, panel type with discharge rack
- *b)* Charger (15-battery size) with rack
- *c)* Charger (6-battery size)
- *d)* Gas stove (small)
- *e)* Lead-burning torches, with gauges and piping
- *f)* Plate racks

Bench
- *a)* Electric test, elaborate
- *b)* Electric test, simple
- *c)* Work, with vises
- *d)* Work, portable with vise

Blackboard
Blowtorches — 1-qt. size
Bookcase
Brake
- *a)* Adjusting stand
- *b)* Band-lining machine

Bulletin Board
Cabinets
- *a)* Wood or metal, for bolts and supplies
- *b)* Wood or metal, for filing job sheets and correspondence

Chain Hoist — with overhead trolley and track
Chairs
- *a)* Teacher's
- *b)* For tables, or with tablet arms

Crane — portable
Crankshaft Truing Tool
Creepers
Desk — teacher's
Drill
- *a)* Breast
- *b)* Hand
- *c)* Electric portable, ½ in.
- *d)* Electric portable, ¼ in.
- *e)* Press, 21 in., with motor and chuck

Dynamometer — electric
Forge — with blower and tools
Furnaces — gas
Grease Dispensers
Grinder
- *a)* Cylinder with motor
- *b)* 8 in., with motor
- *c)* 12 in., with motor

Hones — cylinder
Jacks
- *a)* Lever, 1½-ton
- *b)* Floor, roller

Lathe
- *a)* 11 in. x 4 ft., with motor, chucks, and attachments
- *b)* 16 in. x 6 ft., with motor, chucks, and attachments

Press
- *a)* Arbor
- *b)* 30-ton

Spray Painting Outfit
Valve Refacing Machine
Vulcanizer
- *a)* Electric steam for tube work
- *b)* Small, hand

Welding Outfit — with tanks, gauges, and cutting torch
Wheel Alignment
- *a)* Gauge
- *b)* Test table

Small Tools for Automotive Shop

Alcohol Tester
Battery
- *a)* Cell tester, prod type
- *b)* Cell tester, cadmium
- *c)* Clips, large
- *d)* Element pullers
- *e)* Fillers
- *f)* Funnels, glass
- *g)* Hydrometer, acid
- *h)* Knives
- *j)* Post builders
- *k)* Post drills
- *l)* Post markers
- *m)* Separator trimmer

Bits
- *a)* Expansive
- *b)* Ratchet brace
- *c)* Wood, 3/16 in. to 1 in.

Bolt Cutter — 24 in. and 36 in.
Calipers — 6 in. inside and outside
Cans
- *a)* Oil, 1/3-pt.
- *b)* 1-gal., gas, safety
- *c)* 5-gal., gas, safety
- *d)* 5-gal., kerosene
- *e)* Waste

Checks — tool, 1,000, blank
Chisels
- *a)* Cape, 3/8 in. and 5/8 in.
- *b)* Cold, 3/8 in., 5/8 in., ¾ in., 1 in.
- *c)* Diamond-point

Combination Squares — 12 in.
Cotter-Pin Extractor
Dividers — 6 in. and 10 in.
Drill Sets
- *a)* 1/32 in. to ½ in., by 64ths
- *b)* ½ in. to 1¼ in., by 32nds

File Cards
File Handles — assorted
Files
- *a)* Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b)* Half round, 6 in., 8 in., 10 in., and 12 in.
- *c)* Mill, 6 in., 8 in., 10 in., and 12 in.
- *d)* Round, 6 in., 8 in., 10 in., and 12 in.
- *e)* Square, 8 in., 10 in., and 12 in.

Fire Extinguishers — Pyrene and Acid
First-Aid Cabinet and Supplies
Floor Brushes — 18 in.
Funnels — tin, assorted sizes
Gauges
- *a)* Air pressure
- *b)* Center
- *c)* Depth
- *d)* Thread
- *e)* Thickness

Glass Cutters
Goggles
Grease Guns — plain and pressure-type
Hammers
- *a)* Ball-peen, 4-oz.
- *b)* Ball-peen, 1¼-lb.
- *c)* Ball-peen, 2-lb.
- *d)* Lead
- *e)* Riveting
- *f)* Sledge, No. 12

Ladle
- *a)* 3 in. bowl
- *b)* 6 in. bowl

Lamps — extension, with reels
Lead Pot — gas
Magnet Charger
Meters — volt and ammeter test
Micrometers
- *a)* Outside, 0 to 1 in.
- *b)* Outside, 2 in. to 3 in.
- *c)* Outside, 3 in. to 4 in.
- *d)* Inside, 1½ in. to 6 in.

Molds
- *a)* Battery nut
- *b)* Battery post
- *c)* Battery strap
- *d)* Burning stick
- *e)* Lead hammer

Oilstone
Pipe Taps — 1/8 in., ¼ in., 3/8 in., and ½ in.
Pliers
- *a)* Combination, 6 in.
- *b)* Flat nose
- *c)* Round nose

Pullers
- *a)* Bearing
- *b)* Gear
- *c)* Wheel, hub type

Punches
- *a)* Center
- *b)* Taper pin
- *c)* Blacksmith

Putty Knives
Reamer — splindle bolt
Reamer Sets
- *a)* Piston pin, ½ in. to 1⅜ in.
- *b)* Taper pin
- *c)* Valve seat

Saws
- *a)* Hack, frames, 10 in., adjustable
- *b)* Hack-saw blades, 18, 20, and 24 teeth
- *c)* Hand

Scales
- *a)* Steel, 6 in., graduated 1/64 and 1/100 in.
- *b)* Steel, 12 in., graduated 1/32 in.

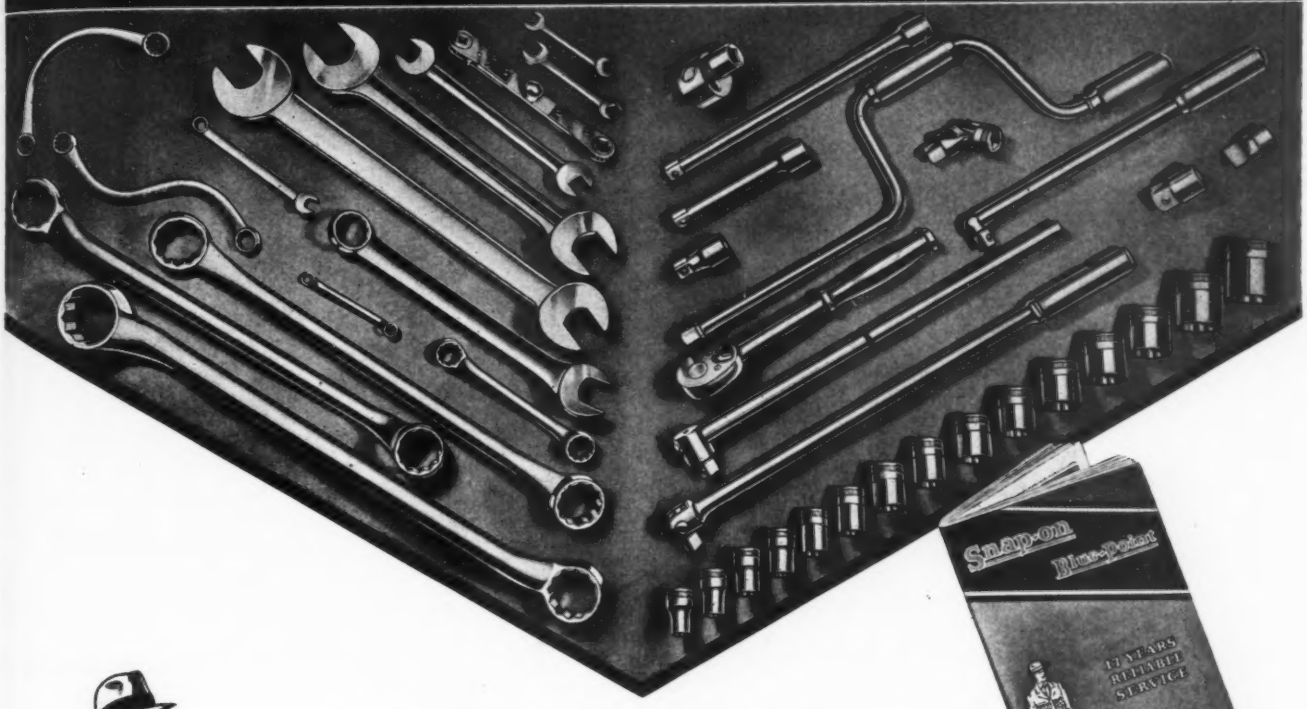
Scrapers
- *a)* Bearing
- *b)* Carbon

Screw Drivers
- *a)* 6 in. and 12 in.
- *b)* Small combination

Screw Extractors
Scribers
Snips — tin, 3 in. straight and 3 in., curved
Soldering Coppers — 1-, 2-, and 3-lb. with handles
Spring Spreaders
Stamps
- *a)* Figures, 3/16 in.
- *b)* Letters, 3/16 in.

(Continued on page 36A)

CHOOSE YOUR TRAINING TOOLS
from "The Line Auto Mechanics Prefer"



As a man responsible for the supervision and thorough vocational training of many young Americans, you are vitally interested in the necessity of conducting such training with equipment which approximates actual working conditions in the particular trade being taught.

The engineering and designing departments of this organization have for many years been privileged to assist leading car manufacturers in the development of tool equipment from both production and servicing standpoints . . . today Snap-on is the acknowledged leading producer of mechanics wrench and hand tool equipment, and Snap-on—Blue-Point tools are used and recommended by service mechanics throughout the world, as well as on the assembly lines of most automobile manufacturers.

Guided by these facts, many foremost vocational schools have for some years depended entirely upon Snap-on for their auto shop tool requirements and have periodically invited us to give actual demonstrations of the use of standard and specialized Snap-on tool equipment for the benefit of student classes. We would consider it a privilege to extend you the same service.

The Snap-on—Blue-Point lines include complete ranges of Sockets, Boxockets, and Open End Wrenches in a wide variety of types, a well-rounded out selection of mechanics hand tools, including Hammers, Screw Drivers, Pliers, Chisels, Punches, etc., necessary shop crib tool equipment of every kind, and specialized automobile repair and service tools.

Genuine Snap-on Wrenches and Blue-Point Tools can be purchased only through our own distributing branch warehouses located in 37 principal cities, and through their local service salesmen. We invite your inquiry regarding our service facilities and special school discount and will be glad to reserve for you a copy of our new 1937 catalog to be issued April 1st. The coupon is for your convenience.

Mail this Coupon for free Catalog-1600 Tools

SNAP-ON TOOLS, INC.
Kenosha, Wis.
Please reserve my copy of 1937 catalog ☐
and send service information
Please have representative call ☐

NAME _____

ADDRESS _____

CITY _____ STATE _____

Snap-on Socket Wrenches

SNAP-ON TOOLS, INC.

KENOSHA - WISCONSIN
Factory Branch Warehouses in 37 Principal Cities

Blue-Point Mechanics Tools

THE FUTURE OF YOUR BOYS

DEPENDS ON THEIR ANSWER TO THE QUESTION: *WHAT CAN YOU DO?*

THEIR FATE IS IN YOUR HANDS. YOU CAN HELP THEM BY TEACHING

WROUGHT IRON AND BEATEN METAL

NOT JUST TWO SUBJECTS—BUT TRADES IN WHICH ARTISANS ARE NEEDED.

SUBJECTS THAT EMBRACE MUCH OF USE IN OTHER TRADES AND HOBBIES.

• FILING • FORGING • BENDING • DRILLING • SAWING • RIVETING • TAPPING • TWISTING • READING OF DRAWINGS

• EMBOSSING • PLANISHING • CHASING • RAISING • SOLDERING • ETCHING • PIERCING • CHASING • FUNDAMENTALS OF DESIGN

OUR FIVE DEPARTMENTS WILL CONTINUE TO ASSIST IN THE CHOICE OF YOUR REQUIREMENTS

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Not Just DESIGNS But Jobsheets of artistic merit. Full layouts with step-by-step instructions of simple and advanced projects. Also Kits of Materials to make them.

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Not Just MATERIALS But Added to the commonly known Sheets & Bars of Iron, Copper, Brass, etc. Items for trim, such as Ornaments, Terminals, Fancy Tubing, etc., etc

DEPT. T — METAL WORKING TOOLS
Not Just TOOLS But A variety, carefully selected for Wrought Iron and Beaten Metal Work, many of them our own design. Quality Tools at the right price.

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Not Just BOOKS But Our own Design Series "Art in Iron", together with only such other books that we can conscientiously recommend for good design and practice.

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LITERATURE OF OUR 5 DEPARTMENTS—TREATISES ON FINISHING OF IRON AND ETCHING—FREE TO TEACHERS

THE WROT IRON DESIGNERS 541 WEST 35TH STREET NEW YORK N.Y.

(Continued from page 34A)

Tap-and-Die Sets
- *a*) Machine screw
- *b*) S.A.E. ¼ in. to 1 in.
- *c*) U.S.S. ¼ in. to 1 in.

Tire Tools
Tool Kit — metal box or canvas roll, empty
Twist Drills — (extra sets) selected sizes
Valve
- *a*) Grinders (hand)
- *b*) Spring lifters

Wrenches
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., U.S.S. and S.A.E.
- *j*) Valve-tappet wrenches

Supplies

Acetylene Gas — in drums, for welding
Acid
Alcohol
Babbitt
Bearing Blue
Bearing Compound
Bolts
- *a*) Machine, selected sizes
- *b*) S.A.E., selected sizes
- *c*) Stove, flat or round heads, selected sizes

Brake Juice — ½-pt. cans
Brushes
- *a*) Paint
- *b*) Spark-plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

Chamois
Coil-Spring Assortment
Copper Tubing
Cotter Pins — assorted sizes
Crocus Cloth
Distilled Water
Drain Cocks
Electrolyte
Emery Cloth — Nos. 00, 0, ½, and 1
Enamel — *Auto Painting*
Gaskets
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

Gasoline
Grease — cup, cans
Kerosene
Keys, Whitney — assorted
Lacquer — colors
Lead
Lubricant — transmission
Nails and Brads
Nuts
- *a*) S.A.E., castellated, square, hexagon, selected sizes and kinds
- *b*) U.S.S., square and hexagon, selected sizes
- *c*) Machine-screw, selected sizes
- *d*) Wing, selected sizes

Oil
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

Oxygen — in drums for lead burning
Pig Lead
Piston-Ring Compressors
Radiator Hose
Rivets — brake-lining, 5/16 in., ½ in., and ¾ in. long
Sandpaper — Nos. 00, 0, ½ and 1
Screws
- *a*) Flat-head or round-head, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds

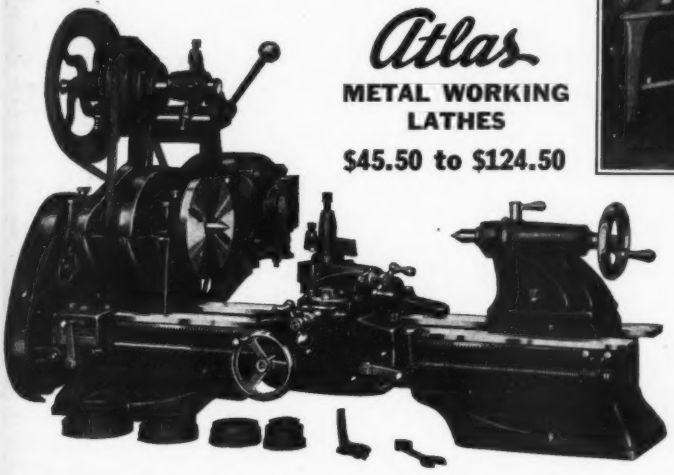
Sealing Compound
Shellac — ½-pt. cans
Shim Stock
Soapstone
Solder — bar, wire, or self-fluxing wire
Soldering Paste
Spelter — for brazing
Sponges — ½-lb.
Starting Cable
Tacks and Staples — upholstery
Tire
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

Valve-Grinding Compound — coarse and fine
Washers
- *a*) Lock, assorted sizes
- *b*) Wrought-iron

Waste
Wire — primary and secondary

"Give more students a chance with low-priced precision lathes," say modern instructors

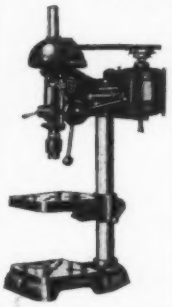
Today's philosophy of education recognizes the importance of giving students a chance to "create" something with their own hands, prepare them for industry, and develop a hobby that will give them life long satisfaction. Shop courses are crowded, but budgets are still low. Atlas helps solve both problems.



Atlas
METAL WORKING LATHES
$45.50 to $124.50

This 36" back-geared model Atlas is ideal for the school shop. It costs but $97.50, less motor, and *includes as regular equipment* built-in adjustable countershaft, complete V-belt drive, automatic, reversible power feeds, gears to cut 4 to 96 threads an inch, and other features that cost over $35.00 from other sources in addition to the basic lathe price. And the Atlas is ruggedly built to stand inexpert student use. Such value invites investigation.

Drill Presses
$16.45 to $42.45



A busy corner in the metal working shop of Central High School, Kalamazoo, Michigan. Like many other shop instructors, Mr. York Duffy agrees with the statement, "Better to have several low cost lathes than one high priced lathe and a waiting line."

Metal and wood working lathes, drill presses, arbor presses, motors, grinders, tools, attachments —see the latest in shop equipment by sending for this big new 52-page catalog.

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DIXON BETTER TOOLS FOR ART METALCRAFT

EDUCATIONALLY, Art Metalcraft promotes creative artistry and originality; trains eyes and hands for skilled coordination; compels thought, planning and ingenuity.

That is why Art Metal courses are so strongly indorsed by Educators—why so many additional high schools and colleges are adding this subject to their curricula each year.

You may be interested in the consideration of Art Metal classes in your school system. If so, our Technical Service Department will freely, gladly and without obligation answer any queries and send you much helpful information about this popular subject. Just write.

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Catalog sent FREE to Teachers and School Officials. Please give Name Address, School, and Subjects Taught.

RHODES 7" SHAPER

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SHAPERS
SLOTTERS
RMCo

Easily converted into 3½" Slotter, making two machines in one.

Available with countershaft drive, or with motor drive, using ½ H. P. motor, thus making a self-contained unit. Occupies small space. Priced low. Send for bulletin.

THE RHODES MFG. CO.
WALTHAM, MASS.

(Continued from page 22A)

K. *Responsible* — accurate in details of assigned task, dependable under all circumstances, worthy of confidence, steadfast.

L. *Punctual* — reliable, dependable, on time. "On the job," including extra hours when essential for accomplishment of worth-while objectives. Conscientious attitude toward position.

M. *Guidance* — inspires pupils — able to appreciate and discuss their problems and interests. Character education, lifts pupils to a higher moral standard.

N. *Enthusiasm* — possesses interest and "pep" in his work. Is possessed of a "contagious" enthusiasm. Proud of the work being done, yet recognizes human tendency to err, optimistic, cheerful.

O. *Tolerant* — open-minded — mentally alert, willing to learn, flexible not dominated by custom. Has vision and desire to improve methods and results.

P. *Progressive* — aware of present "trends" up-to-date, not radical nor overconservative. Aware of vocational changes. Keeps adding to and improving on expected objectives of industrial arts.

General Characteristics

A good teacher should have superior mental ability and an interest in the maintenance of high standards. Certain general characteristics seem essential for success as a teacher in any department of any school. In some instances, certain of these appear dominant; for some individuals others may be considered relatively unimportant. All superior teachers are able to accomplish their work effectively and harmoniously. The mere possession of certain essential traits will not necessarily assure success; it is the composite character that determines this. Such characteristics as the following are essential for an industrial-arts teacher:

A. *Resourceful* — utilizes available materials, does not "quit." Original, possesses vision, has the power of expression.

B. *Citizenship* — has civic pride or community spirit. Respects authority. Genuinely concerned in maintaining or improving the social order. Is patient, but firm in requirements. Straightforward.

C. *Approachable* — sympathetic, not haughty, indicates an honest interest in the pupil's problems. Friendly under all circumstances. Cordial, trusted, not "too big" for his job.

D. *Courage* — both mental and physical. Follows own convictions, yet not contentious or overbearing. Is not a "yes" man. Dependable in an emergency, takes blame when necessary.

E. *Moral* — ethical, believes in doing right. Lives in harmony with the accepted social and moral standards of the community. Not intolerant toward the religious, beliefs of others, and habitually lives a "moral" life.

F. *Discretion* — particularly applicable to those individuals burdened with the senseless habit of "gossiping." Reticent in discussing people or work. Tactful. Does not overpraise. Altruistic.

G. *Honesty* — mere habitual or material honesty not sufficient, mental and moral courage demanded when "under fire." Does not equivocate when definitely asked a question, yet does not violate confidence imposed in him.

H. *Courtesy* — possibly more than other characteristics, this one is respected by students and expected by administrators. Has due respect for the opinions and the knowledge of others. On good terms with school patrons.

J. *Humor* — wholesome life outlook, cheerful, not gloomy or grouchy, possesses a "sense of humor."

K. *Fairness* — impartiality to all, special favors to none. This probably is the principal characteristic for gaining the student's respect and lasting approval.

L. *Patience* — an absolute essential for all teachers, not only must one exercise this trait toward students, but also to patrons and school officials. "Level-headed."

M. *Voice* — pleasant, distinct, instills respect, commands attention.

N. *Poise* — conceals or controls emotions. Calm. Adroit and alert, dignified, "at ease." Creates impression of adequate reserve. "Cool-headed."

O. *Interest* — full of vitality. Possesses the power of concentration. Genuine concern about educational outcomes. Range of interest includes subject as well as individuals. "Wide awake."

P. *Health* — mental balance, foresight, has good physique, posture. Takes sufficient exercise, indulges in proper kind of recreation, appears efficient.

Professional Characteristics

To be a good teacher, requires much preparation. The "teacher-to-be" must receive both a general or broad professional education, and a specific or narrow subject training. Essentials of teaching method vary little from subject to subject. To keep "up-to-date" much effort must be made — reading must be done, conventions must be attended, and of most importance, the teacher must progress through his own experiences. The temporary teacher will be slightly interested but the "teacher-for-life" must maintain or lift standards and benefit the public. Such professional characteristics as the following are requirements for the industrial-arts teacher:

A. *General education* — view of the entire field, at least limited knowledge of general objectives, a broad training, producing an integrated program.

B. *Specific knowledge* — the philosophy underlying industrial-arts work, intensive study of method, a knowledge of specific objectives. Specialized training for general workshop.

C. *Professional interest* — looks upon teaching as a permanent occupation not as a "stepping-tone." Interested in other departments and activities of his school.

D. *Professional attitude* — honest belief in the social worth of teaching. Professional ethics. Exercises professional good judgment, co-operates with associates, is loyal to the profession.

E. *Appreciation* — happy in the profession.

F. *School activities* — initiates or leads in "worth-while" school or community activities, also is a good follower. Does not shun reasonable extra duties.

G. *Professional co-operation* — serves to produce co-operative students. Not deceitful — loyal to delegated leaders and associates.

H. *Educational trends* — aware of present-day changes and able to evaluate them. Interested in general trends in other fields, but specifically in industrial-arts trends and the changes in his subject matter needed to meet them.

J. *Professional habits* — methods of keeping "up-to-date," magazines, books, lectures, conventions. Is a participant, as well as a listener. Interested in departmental problems and their solution.

K. *Efficient methods* — regular and complete daily preparation, definite assignments, skillful questioning, modern testing.

L. *Routine duties* — dependable and correct, regular and punctual, does work without being reminded. Methods of checking special and general tools.

M. *Classroom management* — working order, disciplinary measures. Equipment use, regular care of equipment, equipment is properly arranged, work aisles and aisles of travel planned.

N. *Proficiency* — welcomes suggestions for improvement, makes suggestions for or asks permission to make changes.

O. *Recognition* — individual differences, plans remedial work, stimulates work of all.

P. *Personal growth* — makes effort to secure advanced training.

There is little difference in the criteria for judging industrial-arts teachers and those in other fields. The opportunities for development in this department excel those in practically all scholastic fields, because the work is both essential and general. Unfortunately, school administrators are usually unaware of the possibilities of the work in modern industrial arts.

Offers Course in Diesel Engines

A short course in Diesel engines, of four weeks of intensive instruction in operation, servicing, and care and maintenance of Diesel-engine equipment, was recently offered by the University of Wisconsin, under the direction of the college of engineering and the extension division. The enrollment of students was restricted and an instruction fee of $25 was demanded.

Conference in New York City

The thirteenth annual Junior High School Conference will be held on March 12 and 13, at New York University, in New York City. Information concerning the meetings and the speakers may be obtained from Mr. Maurice S. Hammond, chairman of the conference.

Printshop Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Bellows
- *a*) Hand, small size
- *b*) Electric, blower type

Blackboard — permanent or portable

Bookcase — for reference books, catalogs, etc., sectional preferable

Brayer — 6 in. or 8 in., for proofing

Brushes
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

Bulletin Board

Cabinets
- *a*) Galley, for double-column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school-type, each to accommodate two California cases, job cases, case slides, galley slide, and copy holder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *j*) Type, complete with 24 full-size California job cases, double work bank, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.

Cans
- *a*) Benzine, pint-size
- *b*) Benzine, 5-gal. size
- *c*) Kerosene, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

Cases
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼-size, for ornamental borders
- *c*) Lead and slug, regular-size, to hold labor-saving fonts of leads and slugs
- *d*) Metal furniture, to hold labor-saving fonts
- *e*) Rule, ¼-size, for brass rule

Chairs — teacher's and tablet-arm

Chase Racks
- *a*) For platen presses
- *b*) For cylinder presses

Chases
- *a*) For each size of platen press
- *b*) For cylinder press

Composing Sticks — 6 in. x 2 in., 8 in. x 2 in., 12 in. x 2 in., and 18 x 2 in., adjustable

Cutter
- *a*) Lead and rule
- *b*) Paper, lever-type, 20 in., with pedestal. Should handle 20 in. x 26 in. sheet
- *c*) Paper, lever-type, 26 in. or 30 in.
- *d*) Paper, lever-type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

Desk — teacher's, with drawer compartments

Drying Racks
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

Folding Bones — for hand folding

Folding Machine — 20 in. x 26 in. size, 4-fold, two parallel and two right-angle folds, power

Furniture — iron, 2 x 4 to 10 x 15 picas

Galleys — Steel, 8¾ in. x 13 in., 6¼ in. x 23½ in., double column, and 12 in. x 18 in.

Gauge Pins — spring-tongue

Glue Pot — electric, 1-qt. size

Imposing Tables
- *a*) 12 in. x 18 in., with iron top, including reglets and furniture
- *b*) 24 in. x 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 in. x 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 in. x 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

Ink Fountains
- *a*) Short, for 8 x 12, 10 x 15, and 12 x 18 presses
- *b*) Long, for 10 x 15, and 12 x 18 presses

Knives
- *a*) Overlay, for make-ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

Leader Boxes

Leaders
- *a*) 6-pt., 8-pt., and 10-pt., fine dot
- *b*) 8-pt. and 10-pt. hyphen

Line Gauges
- *a*) Metal, brass, or steel
- *b*) Wood

Metal Furnace — for recasting and refining type metal, used only with typesetting machines

Mitering Machine

Numbering Machines
- *a*) For use on presses
- *b*) Hand machines

Ornaments
- *a*) Assorted floral and decorative designs
- *b*) Border, 6-pt. and 12-pt., decorative

Perforator
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

Planer
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple, with leather top

Presses
- *a*) Cylinder, two-revolution, four-roller, 25 x 38, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 x 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 x 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 x 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 x 18, with cabinet
- *f*) Proof, 20 x 24, with cabinet

Punch
- *a*) Foot-power, multiple, with assorted punches
- *b*) Lever, two-die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

Quoins
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

Rule — plain and brass (fonts to fit quarter cases)
- *a*) 2-pt., labor-saving, hair-line, side face
- *b*) 2-pt., labor-saving, 1-pt. side face
- *c*) 1-pt., labor-saving, 1-pt. face
- *d*) 2-pt., labor-saving, double face

Saw Trimmers — pedestal type, with point gauge, and raising and lowering table

Spacing Material
- *a*) Iron furniture, as selected
- *b*) Leads, labor-saving, 2-pt.
- *c*) Leads, 2-ft. strips, 2-pt.
- *d*) Slugs, labor-saving, 6-pt.
- *e*) Slugs, 2-ft. strips, 6-pt.
- *f*) Spaces and quads
- *g*) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

Specimen Display Board

Staple Binder — pedestal-type, foot power

Stitcher — wire, power, capacity ½ in. or ¾ in., flat and saddle-back tables

Tweezers — 3½ in.

Tympan Paper (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

Typesetting Machines
- *a*) Either linotype or intertype, 2 or 3 magazines, and molds
- *b*) Matrices for same, 6-, 8-, 10-, and 12-point, as selected

Type
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt.; 12 pt.; No. 26; 12-pt. No. 27; 12-pt., No. 28; 18-pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt. Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *j*) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30 and 36 pt.
- *k*) Job, heavy copperplate Gothic — 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
- *l*) Wood, condensed Gothic — 8, 12, 15 and 18 line

Supplies

Benzine or Gasoline — for cleaning type or presses

Bindery Tape — 2 in. wide, brown or black

Gold Bronze — pale

Ink
- *a*) Bond, black, for bond papers
- *b*) Book, black, for school paper, etc.
- *c*) Cover, colors as selected
- *d*) Dryers and compounds, as selected
- *e*) Halftone, black
- *f*) Job, colors as selected

(Continued on page 40A)

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Before you buy Print Shop Equipment get complete information on all labor-saving tools and equipment manufactured by H. B. Rouse & Company.

More than 36 years of manufacturing equipment for printers has made Rouse labor-saving devices the standard of the world for efficiency and accuracy.

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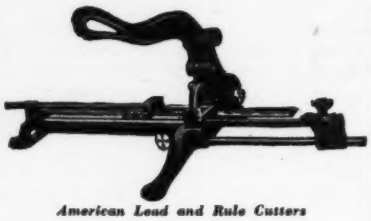

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Rouse Composing Sticks

Rouse Mitering Machines

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(Continued from page 39A)

g) Metallic, gold and silver
h) Process, black, red, yellow, blue

Kerosene — for cleaning rollers

Padding Cement
a) Cold
b) Hot

Paper
a) Bond, fine grade, 17 x 22 — 20, white
b) Bond, medium grade, 17 x 22 — 20, white
c) Bond, sulphite, 17 x 22 — 20, white
d) Bond, sulphite, 17 x 22 — 20, colors as selected
e) Book, enamel, 25 x 38 — 80, white
f) Book, machine finish, 25 x 38 — 80, white
g) Book, eggshell finish, 25 x 38 — 60, white
h) Cover, as selected, 20 x 26, medium
j) Card Bristol, fine grade, 22 x 28 — 4-ply, white
k) Index Bristol, medium grade, 25½ x 30½ — 110, white
l) Index Bristol, medium grade, 25½ x 30½ — 140, white
m) Mill Bristol, medium grade, 25½ x 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 x 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

Paste
a) Bindery
b) Make-ready

Twine — cotton, for tying jobs

Wire Stitching
a) No. 25 round wire for stitcher
b) Wire staples, ¼ in.

Woodblock by Paul Selms, Vol. 72, No. 1, Archiv für Buchgewerbe und Gebrauchsgraphik

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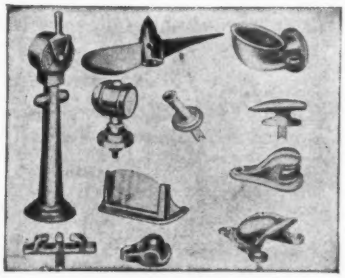

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☐ Radio End Table	☐ Nut Bowl and Hammer	☐ Governor Winthrop Desk
☐ Coffee Table	☐ Fruit Bowl and Candy Dish	☐ Jewel Case and Tray
☐ Cocktail Cabinet	☐ Wood Jewelry	☐ Pin Cushion and Darner
☐ Cabinet and Writing Desk	☐ Dutch Windmill	☐ Magazine Basket
	☐ Portable Boat	☐ Table Lamp—Floor Lamp
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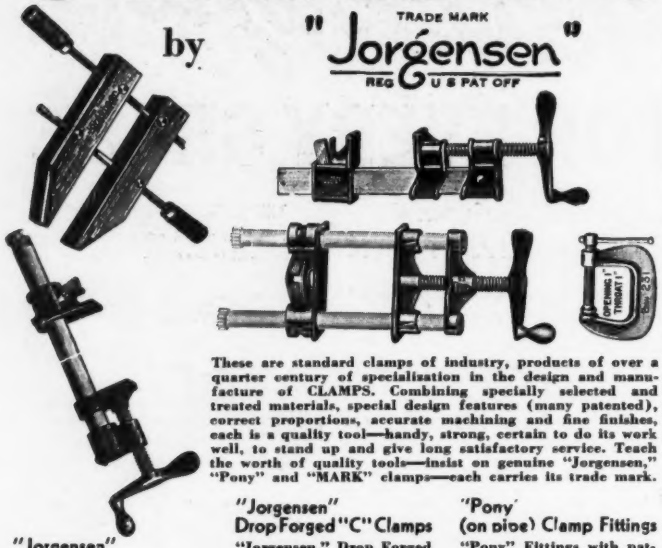
CLAMPS

by "Jorgensen" TRADE MARK REG U S PAT OFF



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"Pony" (on pipe) Clamp Fittings
"Pony" Fittings with patent Multi Disc Clutch. Go on ordinary pipe. Make clamps of any length. Many types including Pony 52 for ¾" pipe.

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Our catalog R will be sent free to shop and craft teachers upon application if position is stated. To others it will be 25c. Full credit given on first order amounting to $5.00.

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SAFETY

America's Deadliest Weapon

Arlyn H. Vance
McNaughton, Wisconsin

More than a million vehicles were involved in automobile accidents last year with a terrifying toll of killed and injured. Yet the estimate for 1937 may safely be predicted as 20 per cent higher than last year's.

Whatever the price we must ultimately pay, highway driving safety will be cheap at any cost. If it becomes necessary to create a sense of individual responsibility by requiring everybody to attend a public safety school and learn not only how to drive correctly, but also how to keep a car in a satisfactory mechanical condition, then the price will indeed be low. Estimates for the past ten years place the national economic loss due to automobile accidents at more than a billion dollars! And a billion dollars will buy a lot of safety education.

Athough literally hundreds of alibis have been given for highway tragedies, there are but two basic reasons for automobile accidents. In every case either a mechanical failure or some human error is to blame. A real civilization should not tolerate this state of affairs for long.

The older cars, those made prior to 1924, had definite performance limits which served as a partial check on reckless and foolish drivers. The cars lacked speed and acceleration although, even with them, dangerous driving was possible and prevalent. But the late models, with their tremendous accelerating ability and top speeds, usually well above eighty miles per hour, offer a ready means for either suicide or murder — if a driver be so inclined. In spite of shatterproof glass and all-steel car bodies, the human frame has not yet improved to the point where it will stand the effects of the sudden stops too often encountered at these high speeds.

Yet, not all human mistakes are made deliberately. Usually they are due to factors most drivers do not fully understand. Likewise, mechanical failures are often due to the fact that the owner or driver has little mechanical ability, and in addition is sure that the car is in good running condition so long as the engine runs and he can steer it well enough to keep between the fences. Safety campaigns quite often prove conclusively that a very large percentage of the automobiles in use are unsafe.

The school auto shop has a definite civic duty to perform in combating the appalling tragedies of our highways, by training both our youth and our adults in correct driving habits.

The teaching of what is best termed "safety mechanics," in a school auto shop is a very easy matter, and is largely that of procedure. Thus, from the standpoint

(Continued on page 45A)

R·MURPHY
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TRADE MARK
KNIVES
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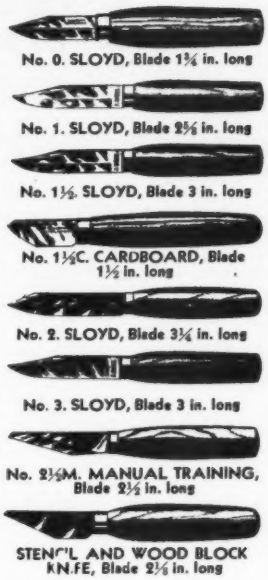
No. 0. SLOYD, Blade 1¼ in. long
No. 1. SLOYD, Blade 2⅝ in. long
No. 1½. SLOYD, Blade 3 in. long
No. 1½C. CARDBOARD, Blade 1½ in. long
No. 2. SLOYD, Blade 3¼ in. long
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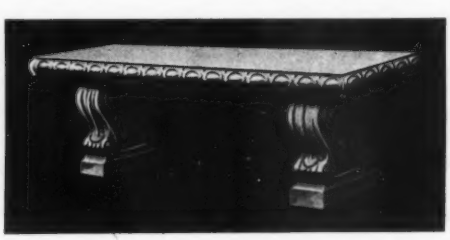
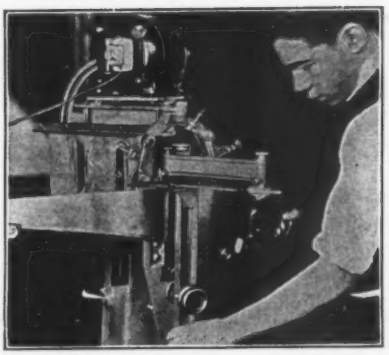


Egyptian Vase 935



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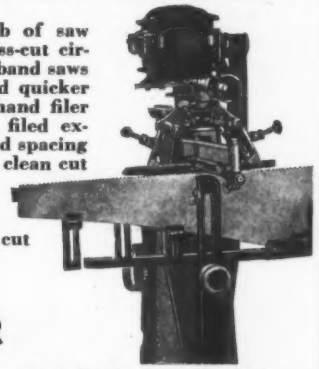
Every manual training instructor knows the importance of sharp, properly set saws, especially in the training of students. In their hands, saws dull quickly, and a fast, accurate method of sharpening them in the school is a decided advantage. The

FOLEY AUTOMATIC SAW FILER



does a quick, perfect job of saw filing. All hand saws, cross-cut circular saws up to 24", and band saws ⅛" to 4½" wide are filed quicker and better than the best hand filer could do. Every tooth is filed exactly uniform in height and spacing so that a smooth, straight, clean cut is assured. No eye-strain in filing with a Foley. If a saw is in bad shape, new teeth can quickly be cut with a Foley Retoother.

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A modern, skillfully organized, junior-high-school text that not only develops the ability to draw and interpret drawings, but provides exploratory contacts with a wide variety of drafting occupations and contains interesting and useful facts about industrial organization, methods, machines, materials, etc. ***$1.48***

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The one essential text for junior high-school woodworking classes. Developed on the unit instruction-sheet plan, it covers the entire range of woodworking. There is a complete analysis of each unit operation and each step in the procedure is set out clearly and distinctly. ***$1.48***

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Besides providing general information on metals, metalworking as a trade, uses of metal for various industrial, commercial, and home uses, this book acquaints the students with a large variety of everyday tools and their uses. ***$1.50***

THE BRUCE PUBLISHING COMPANY

New York Milwaukee Chicago

of safety, an automobile should be considered as a road vehicle with three important major parts. Without question the steering mechanism takes first place from the safety angle, the brakes second, and tires and wheels third. Contrary to popular opinion, the engine has very little value as a safety feature, but will be correctly placed in due course.

Steering gears may be roughly classified as reversible or irreversible. In the former, road shocks are transmitted backward through the steering linkage to the arms of the driver, while in the latter, shocks are absorbed somewhere in the mechanisms itself. Although shock-absorbing springs are provided in the linkage of both types, the irreversible gear is generally better constructed in all ways, and, therefore, a safer gear for most road conditions.

But regardless of the type of gear, a certain degree of mechanical perfection is necessary if a safe steering control is to be attained. The car must, in all cases, have what may be best described as "steering stability," in combination with a definite accuracy of steering control. Anything which tends in any way to destroy either or both of these two factors may be classed as an error of car design, or to a driver's neglect. Even in the hands of a "good" driver, any lack of steering control makes a car a distinctly unsafe vehicle on any highway.

A school examination of steering gears should start with a report, made by some expert driver, of exactly how the car handles on the road. Any failure to secure accurate steering, or any tendency of the car to "wander" over the road, at any speed up to sixty miles per hour should be reported. This limit is established because very few cars should ever be driven at this speed, while the thinking-speed limit of most drivers is generally not over forty miles per hour. Insurance statistics, as a rule, place the safe driving-speed limits at the latter figure.

The school report, presented for class analysis, should also cover any peculiarity of steering when negotiating turns. Slowness of response should be noted, together with any tendency of the gear to bind when attempting to straighten out after a turn. Any apparent looseness, or "play," in the steering connections should also be noted.

In the shop, most mechanics "feel" the play in a steering gear merely by oscillating the steering wheel backward and forward enough to just take up the slack before the road wheels are affected. The amount of this play should never exceed ¼ in. as measured on the rim of the steering wheel. If it exceeds this amount, a check should be made to determine the point where wear is occurring. It is quite possible that an inspection of all cars available will show on many, a play in excess of 1 in. This is a prohibitive amount.

A long pointer lashed to the road wheel, and another tied across the steering wheel will aid materially in showing the amount of play in a gear. Afterward, tests can be made to determine the location of the wear. This is best done by holding a forefinger on each moving part of the linkage in turn and feeling the play while an assistant oscillates the steering wheel. For this test, the wheels should be left on the floor to add resistance to the joints.

The type and kind of gear used will determine exactly where adjustments must be made. However, on most gears an adjustment is usually provided for taking up vertical play in the steering post if this exists. Wear in the ball-and-socket joints of the linkage can in most cases be taken up by a small screw plug provided for that purpose. It is advisable in nearly all cases of excessive play, however, completely to dissemble these connections and inspect for broken shock springs, flattened balls, or other wear which might allow the link to fall off on the road. Many fatal accidents have been traced to this cause.

The tie rod should also be closely inspected for worn parts. This is best done by jacking up the front end of the car, and then attempting to shove the front wheels apart or to draw them together. This is done by hand, and play can usually be felt quite easily. Repairs will depend on the type of rod ends used.

Since accurate steering depends upon the relative tightness of the entire front end of the car, a thorough inspection also should include an examination of the spring clips, shackle bolts, wheel bearings, and steering-knuckle pins. If excessive play is present in the wheel bearings, the wheels should be removed and the bearings examined for broken or worn parts.

Camber, the tipping outward of the front wheels at their tops; castor, the inclination of the steering-knuckle pin toward the rear at its top; and toe-in, or amount the front wheels are closer at the front than the back, should also be checked carefully, preferably to the manufacturer's specifications. These three have a very definite relation to the way a car handles on the road, and must be correct at all times or serious trouble may ensue.

The inspection, or repair job is concluded by a careful examination to see that all cotter pins have been replaced, and that lubrication has been properly cared for. The wheels are swung from side to side to check for "tight" points, which must not be present, and, finally, a road test should be made.

GUIDANCE

Guidance and Industrial Arts

Louis F. Barocci

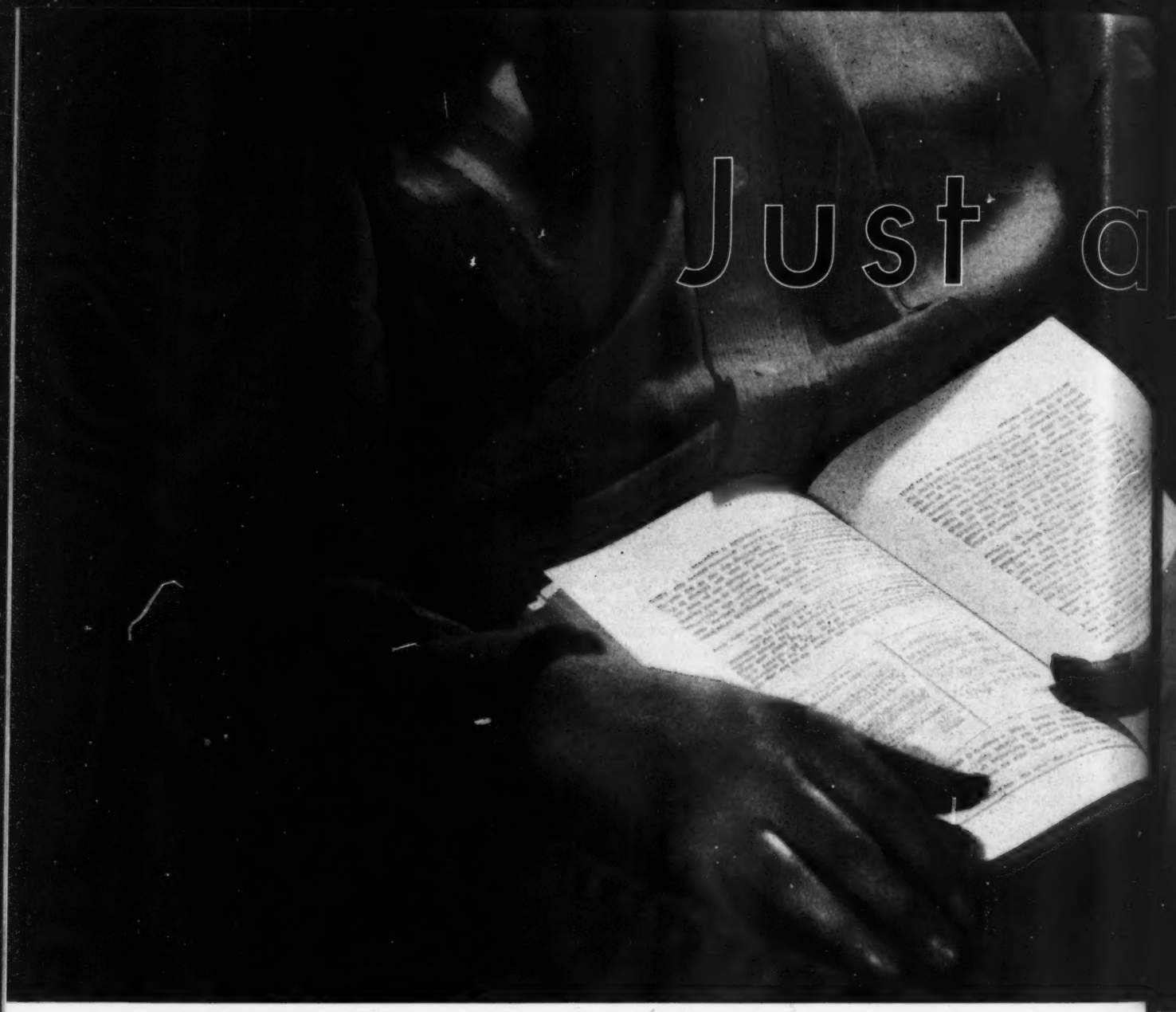
High School,
Cudahy, Wisconsin

A plea for industrial-arts teachers to assume the duty of properly guiding their students.

There are still many industrial-arts teachers who spend all their allotted time in the shop for teaching the fundamental mechanical processes, arguing that this is explicitly the mission of the shop teacher. They do not consider themselves obligated to be the moral, spiritual, and educational guides of their pupils. Their method of teaching does not involve vocational guidance beyond transmitting to the students the skill required to produce the particular article made in the shop.

Other industrial-arts teachers consider it their duty and opportunity to go further. They view the future of their students from many angles. Their finished product in the shop may suffer by comparison with the first-mentioned teacher, not because accuracy and speed have not been emphasized, but because part of the time has been spent on material not included by the first teacher.

(Continued on page 48A)



● They belong to a boy. They are still insensitive, untrained, inexpressive hands. The majority of their movements are purposeless, blind, fumbling. Yet to a great extent the future of their owner depends on them.

Those who study the Evolution of Man believe that much of his development has come about through the power to oppose thumb to fingers—in a word, to *grasp;* the greater variety of movements thus made possible has caused corresponding greater development in the brain. To what extent this is true, we must leave to the thoughtful person to decide.

We do know that the ability of the brain to judge is linked closely to the ability of the hand to grasp, pick up, feel and weigh an object; to learn the difference between textures and surfaces. The sensitive eye of the artist is always paired with a sensitive hand. And love of true craftsmanship can only follow intimate experience in craftsmanship. Thus are defined the moving forces that have lifted man to the stars . . . judgment, precise thinking, imagination, craftsmanship and ideals.

# of hands

How essential it is, then, that every instructor who is concerned with his *true* responsibility should create the proper attitude, the proper respect for the drawing instruments his students use. These are usually the first fine instruments of precision to come into a boy's hands. They are the first tools to help his hands and mind through the disciplines of precise thinking, controlled craftsmanship, persistence toward a goal. Very often these are the only instruments in the development of creative ability which he will ever know. Thus it becomes imperative that the instructor show proper concern in the quality, in the accuracy . . . *in the maker's name on drawing instruments* . . . or lose forever the golden opportunity to foster the selective *habit* which will exert its influence throughout all the ensuing years of his students' lives.

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Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Adjustable-Curve Ruler
Beam Compass
Bench Brushes
Blackboard
- *a*) Permanent or portable
- *b*) Compass, 15 in., with locking device
- *c*) Drawing set: T square, straightedge, triangle, and protractor

Blueprint
- *a*) Frame or machine
- *b*) Washing trays or washer
- *c*) Paper tube, air-tight
- *d*) Drying rack or dryer

Bookcase
Cabinet
- *a*) For filing drawings
- *b*) For storing drawing boards
- *c*) For storing drawing instruments
- *d*) For storing models

Calipers — 6 in. and 8 in., inside and outside
Chair — teacher's
Desk — teacher's
Dividers — proportional
Drafting machine — and accessories
Draftsman's Steel Protractor
Drawing Boards — large
Drawing-Board Supports — to be set on or attached to woodworker's bench
Drawing Tables and Stools
- *a*) For Students
- *b*) For Teachers

Ink-Bottle Holder
Irregular Curves — Nos. 17, 21 and 24, wood, rubber, or transparent
Lettering Angles
Lettering Pens — assortment of 12
Level or Transit — builders' for architectural students
Leveling Rod — for use with the transit
Machinists' Combination Set — 12 in.
Marking Pins — for use with measuring tape, for architectural students
Micrometer — 1 in., for mechanical-drafting students
Oilstone — 3 in. case
Pantograph — 21 in.
Parallel Rules
Planimeters
Plumb Bob
Shears — for trimming blueprints and drawings
Speed Counter — for mechanical-drafting students
Steel Scales — 12 in.
Stop Watch — for mechanical-drafting students
Table
- *a*) For cutting and trimming drawings and blueprints
- *b*) For disassembling and reassembling machine parts and models

Tapeline
- *a*) 100 ft. steel, for architectural students
- *b*) 50 ft., steel or metallic

Tool Box — containing 1 machinists' hammer, one 6 in. adjustable wrench, one 6 in. screw driver, one 6 in. combination pliers
Triangles
- *a*) 30–60-deg. 14 in. transparent
- *b*) 45-deg. 10 in. transparent

Triangular Scales — civil engineers' type, 12 in.
T Square — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
Wall Charts — lettering, decimal equivalents, etc.
Yardstick

Drafting—Small Equipment

To be provided by, or for, each student

Drafting — Small Equipment
To be provided by, or for, each student
Drawing Board — size to be specified by instructor
Drawing Instruments — as specified by instructor
Erasing Shield
Irregular Curve — Nos. 8 and 13, transparent
Pencil Compass
Penholder — for lettering pens
Pens — assorted, for lettering
Protractor — not over 5 in.
Scale — 12 in. architects', triangular
Scale Guard
Slide Rule — 10 in., as specified by instructor
T Square — to fit drawing board
Triangles — 30–60-deg., 10 in. transparent, and 45-deg., 8 in. transparent

Drafting Supplies

Bichromate of Potash — crystals
Blueprint
- *a*) Paper, 36 in. wide
- *b*) Writing fluid

Paper
- *a*) Cross-section, 8½ in. x 11 in.
- *b*) Detail, 24 in. x 36 in.
- *c*) Drawing, 24 in. x 36 in.
- *d*) Isometric, 7 in. x 10 in.
- *e*) Tracing, 36 in.

Powder — for tracing cloth
Tracing cloth — 36 in.
Van Dyke
- *a*) Fixing salts
- *b*) Paper, 36 in.
- *c*) Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student

To be provided by, or for, each student
Erasers
- *a*) Cleaning
- *b*) Ink
- *c*) Pencil

Ink
- *a*) Black, waterproof
- *b*) Colored, if required

Pencils — drawing, HB, 2H, 3H, 4H, and 6H
Pencil Pointer Pad
Thumbtacks

(Continued from page 45A)

These teachers think more of the boy as he will be ten years from now. Their vision goes beyond the annual exhibit or the comments of the board of education or of the parents. To them industrial-arts work ceases to be preparation for a vocation and becomes a preparation for life. To them the shop is the best guidance laboratory in the school. They see in it the possibility for the closest contact between teacher and student. They feel that they have an opportunity to learn what is in the students' hearts. He cannot conceal it from them; there are too many avenues of expression.

The shop teacher who has a vision of his larger opportunities will do more than to keep his shop open the required number of hours or produce the required number of projects. He will extend his kindly services into the life of the student and into his home. He will use the school shop as a laboratory for working out bases for life efficiency and soul qualities so much demanded for genuine success.

In an unpublished thesis for a master of science degree, Iowa State College, 1934, entitled "The Functions of the Industrial-Arts Teachers in the Guidance Program of the High Schools of Kansas," S. M. Dell mentions the following types of counseling which the industrial-arts teachers are able to give: (1) Vocational, (2) educational, (3) moral, (4) social, (5) health, (6) teaching.

Data collected for this thesis showed that from the viewpoint of school administrators about 75 per cent of the industrial-arts teachers in Kansas were considered competent to give vocational counseling. The school administrators also registered their opinion that compared with the other departments in the school system, the industrial-arts departments and its teachers

(Continued on page 50A)

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Post produces a complete line of supplies for the Student Draftsman. The design of this merchandise has been guided by the Post supplies that are approved and preferred by Instructors and Professional Engineers. The material is strong and durable. It will withstand any reasonably hard usage.

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No. 92422 — Smooth flowing, extra waterproof, dense and opaque, drawing inks. List price, ¾ ounce bottle each, $ .25; black and 12 brilliant colors. Prices subject to discount to Educational Institutions.

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Size	12x17	18x24	20x24½	20x26	23x31
List price each	$ .62	$1.14	$1.22	$1.30	$1.80

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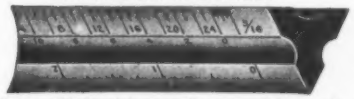
TRIANGULAR SCALES



No. 97301 — Made of best grade seasoned boxwood; machine divided, guaranteed accuracy, divided 1/8, 1/16, 1/32, 1/64, 1/128, ¼, ⅛, 1/16, ½, ¾, 1, 1½, and 3" to a foot. List price each, $ .50. Same scale maplewood, list price, $ .42 each. Prices subject to discount to Educational Instittuions.

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Triangles
Made of good transparent high grade celluloid.

	6"	8"	10"
No. 97746-A — 30 x 60 degree List dozen	$3.40	$4.75	$7.00
No. 97746-B — 45 degree List dozen	3.40	4.75	7.00

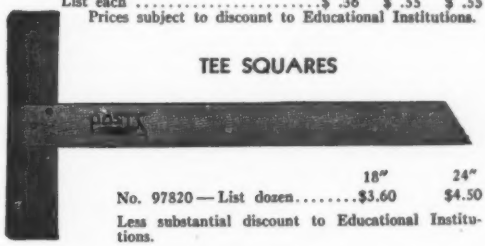
Prices subject to discount to Educational Institutions.

Irregular Curves

	Style 6	13	17
No. 97884			
List each	$ .36	$ .55	$ .55

Prices subject to discount to Educational Institutions.

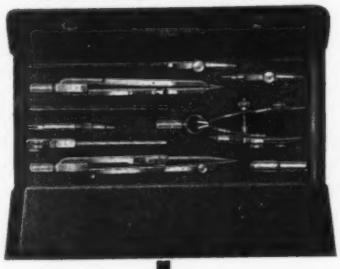
TEE SQUARES



	18"	24"
No. 97820 — List dozen	$3.60	$4.50

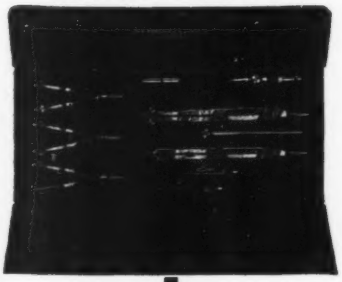
Less substantial discount to Educational Institutions.

DRAWING INSTRUMENTS



A sturdy, accurate set used by many student draftsmen. 4¾" ruling pen, 3¼" combination bow pen and pencil, 4¾" plain divider; 4¾" compass and divider part, pencil part, pen part, and lengthening bar. Pocket book style container. List price, $3.60, less discount to educational institutions.

DRAWING INSTRUMENTS



Pocket book style case, one 4½" and 5½" ruling pens and releases, 3½" bow divider, 3½" bow pencil, 3½" bow pen, 5½" hair-spring divider, 5½" compass with jointed legs, pen part, lengthening bar. List price, $7.50, less discount to Educational Institutions.

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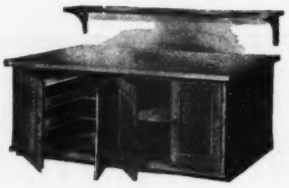
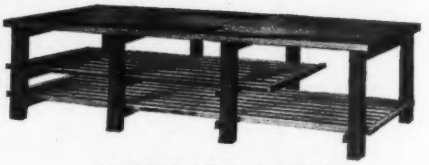

Glue and Stain Bench No. N-3154

Single Manual Training Bench No. N-3088

Drawing Table No. BL-94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Combination Padlock No. K-46A

Combination Padlock No. K-45A

Ever-Hold Adjustable Stool No. E-1824

(Continued from page 48A)

rank high in their ability and position to counsel.

Since the industrial-arts teachers possess this high potentiality for counseling, it is to be regretted that more of them do not avail themselves of these guidance opportunities which would tend to establish more securely in the community and school both the industrial-arts department and the industrial-arts teachers themselves.

In an article entitled "The Industrial-Arts Program as it Relates to Vocation Finding in a City School System," in the May, 1926, issue of the *Industrial Arts Magazine*, Superintendent Harry Wilson, Berkeley, Calif., listed the following:

A. Methods by which "finding" objectives can be exercised by the shop teacher.

1. Participation under controlled conditions as nearly typical of the actual working conditions as possible.

2. Information in the form of reading material on conditions of work and opportunities for promotion in various occupations.

3. Descriptions of technical operations in industrial production in technical books and magazines.

4. Observation of production through supervised visits to places of employment, factories, etc.

5. Correlation of instruction between teachers of academic subjects and teachers of industrial arts.

B. Responsibilities of shop teachers in guidance.

1. Each shop teacher has time to try out the boy in various school shops.

2. Every job and every lesson should contain vocational-guidance factors. The following personal traits of the student should be observed by the teacher:

(*a*) Does he go at his work properly? (*b*) Is he accurate? (*c*) Can he follow directions? (*d*) Is he alert, neat, orderly? (*e*) Does he do a job well? (*f*) Is he satisfied with poor work?

Such a study of his students gives the industrial-arts teacher an opportunity to judge his students better than can any counsellor, supervisor, or teacher, because he sees the boy working on individual projects and with his fellow students every day. He learns to know the student as an individual and not as one of a group.

The effective vocational counsellor is *not* the one who looks up a boy's record and then advises him, but the one who is in contact with the boy from day to day and from job to job.

Advice given when it can be associated with a particular job will stick, while an accumulation of advice and instruction in an interview or lecture is soon forgotten.

The shop instructor can make the work so real that "school" and "life" is an orderly procession instead of being separated by the "transition" stage. To do this, the instructor must know industry, and must know much of it first hand. He must know its policies, its opportunities for promotion, kinds of labor it can absorb, or anything that will have influence on the training given.

In Berkeley, Calif., this knowledge is secured through:

1. Visits to industry by the teacher.

2. Visits to industry by teacher and student.

3. Trade journals, papers, and magazines. These must be made available to the students and they must be requested to use them.

4. Co-ordinators who are constantly in touch with industry.

5. Guidance and placement bureaus where they are in existence.

By these various methods of exploration and counsel and by bringing the boy into intimate contact with industry itself, the industrial-arts teacher does much to help the student determine his choice of work.

At a conference held at Teachers College in 1927, under the leadership of Dr. F. G. Bonser, the following list of guidance opportunities was suggested to industrial-arts teachers:

(Continued on page 52A)

"TO EACH, ACCORDING TO HIS *NEEDS*"

High School Student **A** must select from a few Shop Courses, unsuited to his interests, aptitudes and abilities. Retardation, truancy, and juvenile delinquency sometimes follow.

B finds Courses he needs. Plodding of mind and hand, his continual "why?" and "how?" drive a busy shop teacher to distraction. Results? Frequently, as above.

The Shop work offered interests **C**. Brilliant and dexterous, he is always ahead of the few job sheets the harassed instructor can find time, late at night to prepare for him. Time hangs on the pupil's hands and he sometimes makes trouble in the shop, the school, outside, or in all three.

Each year more shop teachers help themselves and their students, by using I. T. Co. teaching and learning tools, selected from our 500 Blue books and 1800 pamphlet texts, each a unit complete in itself.

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A few texts from representative lists:

ARCHITECTURE AND BUILDING TRADES — AIR CONDITIONING

Carpentry (3 vols.)	546 pp., 412 illus.,	$5.80
Carpentry Job Instruction Sheets, for Day School, Trade and Carpentry Apprentice Classes: 1st Year (23 sheets) $1.15	3rd Year (18 sheets)	$ .90
2nd Year (23 sheets) 1.15	4th Year (20 sheets)	1.00
Air Conditioning (2 vols.)	348 pp., 115 illus.,	3.65

AUTOMOBILE — AVIATION — DIESEL ENGINES

Automobiles and Automobile Engines	166 pp., 95 illus.,	$1.75
Automobile Electric Equipment (3 vols.)	412 pp., 188 illus.,	4.25
Aviation Engines (3 vols.)	501 pp., 213 illus.,	5.25
High-Speed Diesel Engines	162 pp., 75 illus.,	1.80

BLUEPRINT READING — DRAFTING

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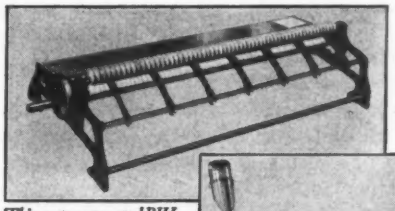

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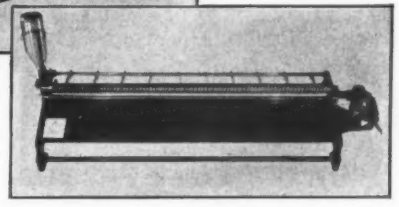

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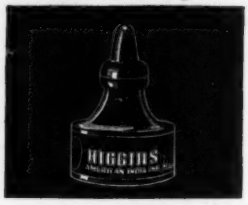

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(Continued from page 50A)

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In an article on "The Collection and Use of Occupational Material in a Vocational Guidance Program" which appeared in the *Industrial Arts Magazine* for December, 1929, Harry S. Belman makes the suggestion that the teacher can use occupational material in shop classes as follows:

1. Bulletins or monographs on occupations may be placed in the school shops where the instructor may use them to discuss careers with the students especially when they desire to make a change.
2. When the shop period is long enough, it may be advisable to set aside 20 minutes for discussion in topics related to the shop activity. Such questions as entrance requirements, possibilities of promotion and details of its operation may be discussed.
3. Occupational information will prove valuable in connection with trips to plants and industries. It will serve to call attention of the students to what they ought to see.
4. The teacher must remember that occupational information is of no value unless it is reliable and up-to-date, presented in an attractive manner, and put to practical use both in the classroom and elsewhere.

Conclusion

From the foregoing, it is quite evident that authorities agree that:

1. Compared with other departments in the school, the industrial-arts department and its teachers rank high in their ability to counsel. Also, that these teachers possess the qualifications which many principals and superintendents think are significant for counseling.
2. Industrial-arts teachers seem to need education in the objective phase of guidance so they will have a sympathetic understanding of student problems.
3. Since the industrial-arts teachers have a high potentiality for guidance, it is imperative that more and more of them should actually attempt to counsel their students and to assume at least a part of the guidance program of the school.

Bibliography

1. Belman, Harry, "The Collection and Use of Occupational Material in a Vocational Guidance Program," *Industrial Arts Magazine,* December, 1929.

2. Dell, S. Milton, "The Function of the Industrial Arts Teacher in the Guidance Program of the High Schools of Kansas." Unpublished Thesis. Library, Iowa State College, Ames, Iowa, 1934.

3. Ericson, Emanuel E., "The Industrial Arts Teacher's Opportunities in a School Guidance Program," *Industrial Education Magazine,* January, 1928.

4. Grant, J. A., "Aspects of the Industrial-Arts Teacher's Job," *Industrial Arts Magazine,* April, 1928.

5. Wilson, Harry, "The Industrial-Arts Program as it Relates to Vocational Finding," *Industrial Arts Magazine,* May, 1926.

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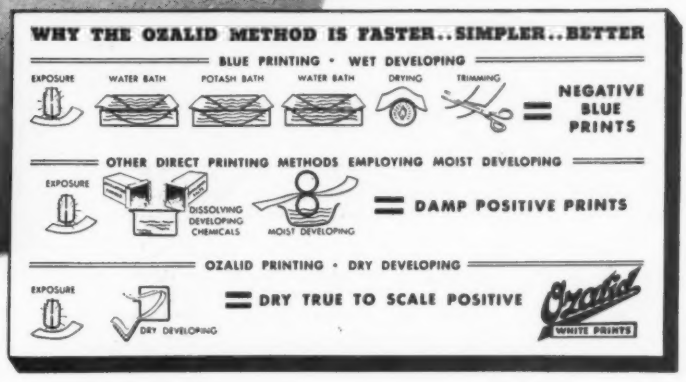

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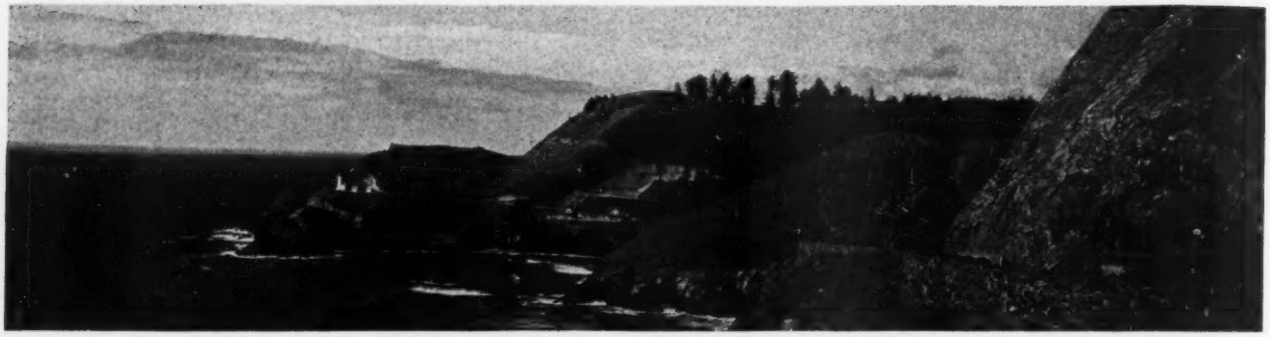

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Casting in the School Shop—VIII

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Reference: *Metallurgy of Non-Ferrous Metal,* by D. M. Liddell, McGraw-Hill Book Co., 1926, 2 Vol. $12.

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Nonferrous castings are those composed of metals, or alloys, in which there is little or no iron, such as pewter, aluminum, brass, and bronze. There are also nickel and monel metal, but because of their high melting points, these cannot ordinarily be cast in the school shop. Castings are rarely made of pure copper. Until recently, copper formed the bulk of the nonferrous group. Aluminum alloys have been developed by the demand for light-weight material for automobile parts and household appliances.

In order to understand the action of these metals scientifically, it will be necessary to refer to reference books on the various metals.

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The absence of lead in grades 1 and 2 makes the metal nontoxic and, therefore, superior to the ancient lead-alloyed pewter.

For previous articles in this series, see January and September, 1934; May and October, 1935; April, September, and December, 1936, issues of this magazine.

Tin, the chief member of the alloy, has important qualities. Whiteness and freedom from oxidation are some of these. Very attractive projects, therefore, can be cast in this metal.

Pewter may be soldered safely by using a 60-per-cent tin and 40-per-cent lead solder. The melting point of pewter is very low, hence it can be easily melted over a gas flame at 425 deg. to 440 deg. F. Pewter shrinks 1/32 in. to the foot.

While melting new or scrap pewter, be sure to have it covered with charcoal.

(To be continued)

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THE MORTISE-AND-TENON JOINT — VII

John E. Doren, Eureka High School, Eureka, California

(Continued from page 130, April, 1936)

With hand-cut tenons, there is often some fitting necessary at the shoulders. If the tenon fits the mortise snugly, this fitting is easy; a saw may be passed through the joint as shown in Figure 33. The saw must cut the tenoned member only, and the sawing must stop before a notch is made in the tenon at the shoulder. It is always necessary to cut both shoulders without disturbing the relative position of the two pieces. The small fillet left in the corner after the saw has been passed through the joint, may be removed with a chisel, as shown in Figure 34.

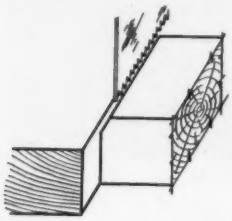


FIG. 33

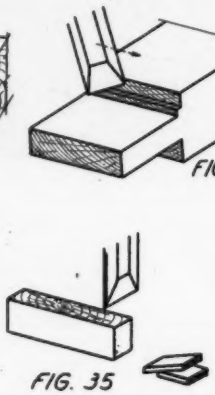


FIG. 35

FIG. 34

B. The Wedge for Wedging Tenons

It is often required to wedge tenons.

All wedges should be straight-grained. To obtain straight-grained wedges, an end may be cut from a piece of reasonably straight-grained lumber equal in length to the length of wedge desired.

With a sharp chisel, segments should be split slightly thicker than the thickest part of the wedge desired. See Figure 35.

The segments should then be shaved to shape with a sharp chisel, cutting against a wooden bench pin or the cleat of a chisel board or bench hook as shown in Figure 36.

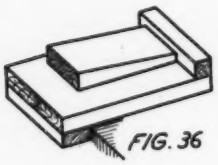


FIG. 36

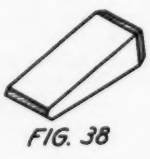


FIG. 38

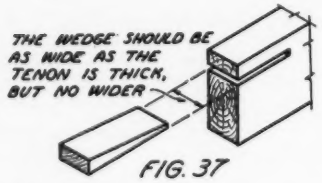


FIG. 37

This will eliminate to a great extent the possibility of cut fingers. The thin end of the wedge should be slightly thinner than the saw cut so that it may enter readily. The wedges should next be split for width and made as wide as the tenon is thick. See Figure 37.

The thin end should be shaped to a quick arris to permit the wedge to be driven hard into a tenon without crumpling. It is often recommended to chamfer the thick end also for the same reason.

C. The Blind Relished-Tenon Joint

When it is necessary to make a mortise-and-tenon joint at a corner of a frame, such as a screen frame, a relished tenon is used so that the mortise in the stile will be entirely closed.

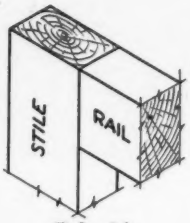
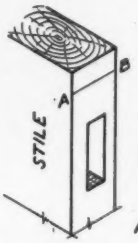


FIG. 39



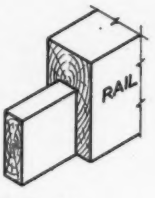


FIG. 40

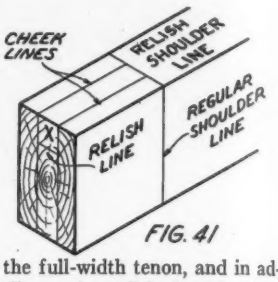


FIG. 41

The assembled joint will look like a butt joint, as is shown in Figure 39.

The simplest form of the relished tenon is shown in Figure 40. In this figure, the mortised and tenoned members are shown as they would appear just before assembling. Notice that the tenon is relished (reduced in width) at the outside edge only, to permit the edge of the rail to finish flush with the end of the stile without showing the mortise. The line A, B, shows where the edge of the rail will meet the stile; this "horn" left between the line and the end of the stile must be cut off *after* the frame is glued up.

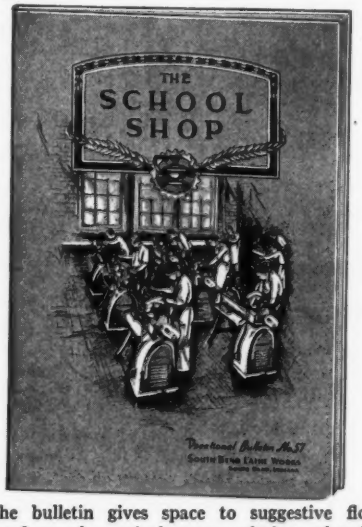
The layout for a relished tenon requires the regular cheek and shoulder lines the same as the layout for the full-width tenon, and in addition, a relish line and a relish shoulder line. Study Figure 41. In this case the relish shoulder line is in the same plane as the regular shoulder line.

(Continued on page 63A)

School-Shop Equipment News

NEW SOUTH BEND SHOP BULLETIN

The South Bend Lathe Works at South Bend, Ind., have announced a new shop bulletin entitled, "The School Shop," which gives considerable space to the description and illustration of various types of industrial-arts and vocational shops, and to recommendations for the most suitable type of shop for the various school needs.



The bulletin gives space to suggestive floor plans for each particular type of shop, showing the most practical equipment, the approximate costs, and suggestions for different kinds of work which may be done in each particular kind of shop.

Several pages are given over to descriptions of projects and exercises in the South Bend machine-shop course. The instruction material consists of blueprints and job sheets.

The booklet is available to teachers and students in school shops.

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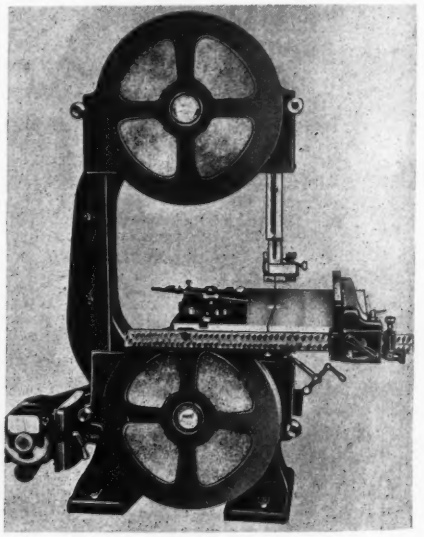

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(Continued on page 60A)

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Dayton, Ohio, 25 N. Main St.
Denver, Colo., 650 17th St.
Des Moines, Iowa, 418 W. 6th Ave.
Detroit, Mich., 700 Antoinette St.
Duluth, Minn., 14 W. Superior St.
El Paso, Texas, 109 N. Oregon St.
Erie, Pa., 10 E. 12th St.
Fort Wayne, Ind., 1635 Broadway
Fort Worth, Texas, 408 W. 7th St.
Grand Rapids, Mich., 148 Monroe Ave., N.W.
Hartford, Conn., 338 Ann St.
Houston, Texas, 1016 Walker Ave.
Indianapolis, Ind., 110 N. Illinois St.
Jackson, Mich., 212 Michigan Ave., W.
Jacksonville, Fla., 237 W. Forsyth St.
Kansas City, Mo., 106 W. 14th St.
Knoxville, Tenn., 602 S. Gay St.
Los Angeles, Calif., 5201 Santa Fe Ave.
Louisville, Ky., 455 S. 4th St.
Memphis, Tenn., 8 N. 3rd St.
Milwaukee, Wis., 940 W. St. Paul Ave.
Minneapolis, Minn., 107 S. 5th St.
Nashville, Tenn., 234 Third Ave., N.
Newark, N. J., 744 Broad St.
New Haven, Conn., 129 Church St.
New Orleans, La., 837 Gravier St.
New York, N. Y., 570 Lexington Ave.
Niagara Falls, N. Y., 201 Falls St.
Oklahoma City, Okla., 119 N. Robinson St.
Omaha, Nebr., 409 S. 17th St.
Philadelphia, Pa., 1405 Locust St.
Phoenix, Ariz., 441 W. Madison St.
Pine Bluff, Ark., 501 Main St.
Pittsburgh, Pa., 436 Seventh Ave.
Portland, Me., 25 Bedford St.
Portland, Ore., 621 S. W. Adler St.
Providence, R. I., 56 Pine St.
Richmond, Va., 700 E. Franklin St.
Roanoke, Va., 202 S. Jefferson St.
Rochester, N. Y., 89 East Ave.
St. Louis, Mo., 112 N. Fourth St.
Salt Lake City, Utah, 200 S. Main St.
San Antonio, Texas, 201 Villita St.
San Francisco, Calif., 235 Montgomery St.
Schenectady, N. Y., 1 River St.
Seattle, Wash., 821 Second Ave.
Spokane, Wash., 421 Riverside Ave.
Springfield, Ill., 607 E. Adams St.
Springfield, Mass., 95 State St.
Syracuse, N. Y., 113 S. Salina St.
Tacoma, Wash., 1019 Pacific Ave.
Toledo, Ohio, 420 Madison Ave.
Tulsa, Okla., 409 S. Boston St.
Utica, N. Y., 258 Genesee St.
Washington, D. C., 806—15th St., N.W.
Waterbury, Conn., 72 W. Liberty St.
Wichita, Kans., 116 S. Main St.
Worcester, Mass., 165 Commercial St.
Youngstown, Ohio, 25 E. Broadman St.

Canada: Canadian General Electric Company, Ltd., Toronto **Hawaii: W. A. Ramsay, Ltd., Honolulu**

Motor Dealers and Lamp Agencies in all large cities and towns

DISTRIBUTOR FOR THE GENERAL ELECTRIC COMPANY OUTSIDE OF THE UNITED STATES AND CANADA.

INTERNATIONAL GENERAL ELECTRIC CO., INC.

New York, N. Y., 570 Lexington Ave. Gen. Sales Office, Schenectady, N. Y.

G-E Educational Service

The General Electric Company is deeply interested in education, as it recognizes that the future welfare of industry, and of the country as a whole, depends upon how well the students of today are trained for the work of tomorrow. It is the policy of the Company to aid the faculty and students of our schools and colleges in every way possible. To this end, Company publications, motion-picture films, illustrated lectures, etc., are made generally available without charge.

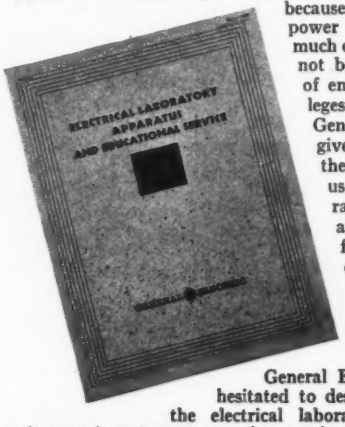
General Electric engineers will be glad to recommend apparatus to meet your special conditions if you will give them details such as: Type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company.

Illustrated Lecture Service

General Electric Motion Pictures are available without charge to educational institutions. They are particularly valuable to schools and colleges, as they enable the student and teacher to keep informed on all important developments in the electrical field.

Complete information on this service is available in publication GES-402C.

In general the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.



Where standard apparatus is not suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop. Among such special equipment may be mentioned the switchboards both for engineering and physics laboratories, special industrial control panels for A-C. and D-C. service, the AHI synchronous motor (or generator), and the 5 kw. rotary converter.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185B which has been recently revised, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Selection of Electrical Shop and Laboratory Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62A will be particularly useful. In this booklet will be found listed in six different groups, equipment to meet a wide range of requirements. For the elementary courses a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well balanced laboratory equipment which will permit a particularly wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Shop Projects

The General Electric Company, in carrying out its elaborate educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop due to the fact that they are not merely assembly projects but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The projects already issued, and available without charge, cover:

Educational Projects.
¼ H.P. and ¾ H.P. Motors.

1) ¼ H.P. Single-Phase, 60 cycle, 110 volt motor Bulletin GES-909
2) ½ H.P. Single-Phase, 60 cycle, 110/220 volt motor Bulletin GEA-2140A
3) ¾ H.P. 3-Phase, 60 cycle, 110 volt motor Bulletin GEA-2138
4) 250 watt compound-wound D-C generator GEA-2289
5) 1½ kw. 220-110/55 volt, single-phase, air-cooled transformer Bulletin GET-569

Kits for these projects can be purchased from the General Electric Company. In addition, complete instructions are given for the securing of any equipment that may not be included in the kit.

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets

Bench Grinder
Benches — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably tney should have electrical outlets
Bits
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in., by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw-driver, ¼ in.

Blackboard — permanent or portable
Blowtorches — 1 qt. size
Bookcase
Braces — ratchet-type, 8 in. swing
Bulletin Board
Cabinets — wood or metal, for filing class records, instruction sheets, drawings, etc.
Chairs — teacher's and tablet-arm
Compass Saw
Coil
- *a*) Spreader
- *b*) Taper
- *c*) Winder

Desk — teacher's, with drawer compartments
Drill
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to ⅜ in. by 32nds

Drill Press
- *a*) Bench, hand or power driven
- *b*) Heavy, power driven

Files
First-Aid Cabinet and Supplies
Hack Saw
- *a*) Blades, 10 in., 24-tooth
- *b*) Frames, adjustable

Hammers
- *a*) Claw, 12-oz.
- *b*) Machinists', ball-peen

Hickey — ½ in. and ¾ in.
Lathe
- *a*) Engine, 10 in. or 12 in. swing, 6 ft. or 8 ft. long
- *b*) Speed

Pliers
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side-cutting, 6 in.

Punches — assorted
Punch — for metal molding
Reamers
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

Rules
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

Screw Drivers — 3 in., 5 in., and 8 in.
Shears — for cutting metal molding
Soldering Coppers
- *a*) Assorted
- *b*) Electric
- *c*) Handles

Solder Dippers
Stocks and Dies — for pipe threads, ½ in. to 1 in.
Vises
- *a*) Machinists', 4 in.
- *b*) Pipe

Wrenches
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop—Supplies

Armored Cable
- *a*) 2-wire, No. 14, single-strip
- *b*) 3-wire, No. 14, single-strip
- *c*) Box connectors

Attachment Plug
Battery Acid — 1.300
Batteries — dry cells
Battery Sealing Compound
Bar Hangers
Box Cleats
Brads — ¾ in., No. 19, and 1½ in., No. 16
Brake Lining — ¼ in. x 2 in.
Brushes — carbon, for motors and generators
Burglar Contacts
- *a*) Open-circuit
- *b*) Closed-circuit

Bushings
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

Buzzers
Cleats — unglazed porcelain, 2-wire
Clips — test, with insulators, Universal, Nos. 22, 23, 24 and 25
Commutator Cement
Conduit
- *a*) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

Condulet
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

Door Openers — mortised
Emery Cloth — 1½ in. wide
Fixtures — brass-chain, suspension
Fixture Studs
Fish Paper — .0125 in. thick
Fuses
- *a*) Plug-type, renewable, 125-volt, 15 amp.
- *b*) Cartridge-type, renewable, 125-volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

Ground Clamps — ⅜ in. to 1 in., assorted
Hickey Grips — ½ in. and ¾ in.
Lamps
- *a*) Carbon, 220-volt, 60-watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

Leather Nail Heads
Lugs — 25- and 50-amp.
Lumber — 2 in. x 4 in. x 14 ft., No. 1, white pine dressed 4 sides
Molding
- *a*) Metal
- *b*) Metal, fittings — crosses, tees, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches
- *c*) Wood, 2-wire, with capping
- *d*) Wood, 3-wire, with capping

Nails — roofing
Nuts — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
Outlet Boxes — 4 in. square, with one round blank cover, and one cover with bushed opening
Pipe Straps — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
Push Buttons
- *a*) Return-call, 3-point
- *b*) Single

Receptacles
- *a*) Flush, duplex
- *b*) Porcelain-cleat, 660-watt, 250-volt
- *c*) Concealed
- *d*) Covers

Resistance Units — 125-ohm
Rosettes — wood
Screws
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, round-head, 4–36 x ¼ in., 6–32 x ½ in., 6–32 x ¾ in., 8–32 x ⅜ in., 8–32 x ½ in., 8–32 x 1 in., 10–32 x ⅜ in., 10–24 x ⅜ in., 10–24 x ¾ in., 10–32 x ¾ in., 12–24 x 1 in.
- *c*) Machine, brass, round-head, 4–36 x ¼ in., 6–32 x ½ in., 6–32 x ¾ in., 8–32 x ½ in.
- *d*) Wood, flat-head bright, No. 5 x ¾ in., No. 8 x ½ in., No. 8 x ¾ in., No. 8 x 1 in., No. 7 x 1½, No. 8 x 1½ in., No. 7 x 2
- *e*) Wood, round-head blued, No. 7 x 1 in., No. 8 x 1½ in., No. 10 x 1½ in., No. 7 x 2

Sleeving — No. 1, white; No. 1, blue; and No. 1, red
Sockets
- *a*) Brushed brass-pull-chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

Socket Caps — ¼ in. and ⅜ in. bushed
Solder Wire — 50/50, size No. 10
Soldering Paste — 2-oz. cans, noncorrosive
Soldering Salts — 1 oz. cans, noncorrosive
Split Knobs — porcelain
Switch
- *a*) Battery, 4-point
- *b*) Bases, porcelain, for 10-amp. switches
- *c*) Boxes, 2¾ in. deep
- *d*) Entrance, safety, 2-pole, 30-amp., with 2-branch lighting circuits
- *e*) Entrance, safety, 3-pole, 30-amp., 250-volt
- *f*) Flush, push-button, S.P., D.P., 3-way, 4-way
- *g*) Surface, S1, S3, and S4
- *h*) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- *j*) Surface, snap, electrolier
- *k*) Surface, snap, S.P.D.P., 3-way, 4-way

Tacks — double-pointed No. 10
Tape
- *a*) Friction, ½-lb. rolls
- *b*) Rubber, ½-lb. rolls

Tubes — porcelain, 5/16 in. x 3 in., 5/16 in. x 5 in., and 5/16 in. x 10 in.

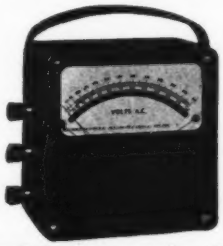
(Continued on page 60A)

TRAIN THE YOUNGER GENERATION IN PRECISION

with "the world's standards of accuracy"

MODEL 540—Ideal miniature portable 6-range D.C. Volt-ammeter. Cannot "burn-out." Independent replaceable fuses protect each of the three current and three potential ranges. Compact Bakelite case. Mirror scale. Range changing switch. Precision type pocket size instrument. Reasonably priced.

FOOT-CANDLE METER—Model 614 measures light intensities directly in foot-candles. Completely self-contained. Easy to use as a Voltmeter. "Human-error" eliminated. A practical instrument for schools.



"JUNIOR" LINE—A complete line of portable AC and DC test instruments of high accuracy . . . small size . . . low cost. Furnished in sturdy, Bakelite cases . . . with knife-edged pointers and mirror scales.

PHOTRONIC CELL — Model 594, dry type—simple in design—a marked advance in light sensitive cells. Current output about 1.4 micro-amperes per foot-candle. Unlimited life. Uses no battery, no amplifier.

MODEL 45 — Portable D.C. Ammeters and Voltmeters. Permanent magnet movable coil type, for general testing. Shielded from the effects of external magnetic fields. Accuracy within ½ of 1%.

Give students that feeling of confidence which comes from using Weston Instruments. Give yourself the satisfaction of purchasing instruments which are recognized the world over as standards of accuracy—a truly sound investment, combining long life and minimized servicing as Westons do.

Weston is continually pioneering in the art, developing new instruments to meet the ever-changing conditions. Outstanding among the recent contributions is the Weston *PHOTRONIC Cell.

This photo-electric cell is of an advanced type. It is radically different in design, simpler, and reduces the cost of application, primarily because it is a miniature power plant which converts light energy into electrical energy. No outside source of potential is needed to operate instruments or relays. Throughout the Weston line, from this new PHOTRONIC Cell to the widely used miniature 3¼" instruments, exacting standards of craftsmanship prevail. The reliable performance resulting from Weston precision manufacture teaches a valuable lesson to the student of science. For this reason, Weston Instruments are the preferred equipment in schools and colleges.

There is a Weston instrument for every electrical testing requirement. Write for your copy of latest catalog, containing descriptive information and prices of the hundreds of models — many range combinations. Weston Electrical Instrument Corp., 595 Frelinghuysen Avenue, Newark, N. J.

*PHOTRONIC—a registered trademark designating the photo-electric cells and photo-electric devices manufactured exclusively by the Weston Electrical Instrument Corporation.

WESTON *Instruments*

(Continued from page 58A)

Tubing — flexible nonmetallic, ¼ in. and ⅜ in.
Rectifiers — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
Relays — Dixie
Resistance Boards — for testing
Rheostats
a) Compression, 275-watt
b) Field, for shunt and compound motors
Rotary Converter — 5-kw. capacity, 3-phase a.c., 110-volt d.c.
Speed Counters — 0–9999
Spring Balances — 0–30 lb.
Starting Boxes
a) For compound motors, various makes
b) For shunt-wound, 1 h.p., 110-volt motors. Overload release
c) For shunt-wound, 1 h.p., 110-volt motors. No voltage release
d) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors
Storage Batteries — 6-volt
Switchboard — as required
Telegraph Sets — including sounders, keys, and relays
Telephones
a) Complete bridging, independent phones
b) Couch vestibule telephones
c) Receivers, transmitters, induction coils, condensers, and bridging switch hooks
Transformers
a) Bell-ringing, 6-, 8-, 14-volt
b) Single-phase, 110–220-volt, S.K.V.A.
Washers
a) Iron, ¼ in. and ⅜ in.
b) Brass, ¼ in. and ⅜ in.
Wire
a) Annunciator No. 18 or No. 20
b) Fixture, No. 18, single yellow, with marker
c) Rubber covered, solid copper, No. 10, black
d) No. 10, white
e) No. 14, black
f) No. 14, white
g) Rubber covered, No. 16, brewery cord
h) No. 18, lamp cord, green and yellow
j) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

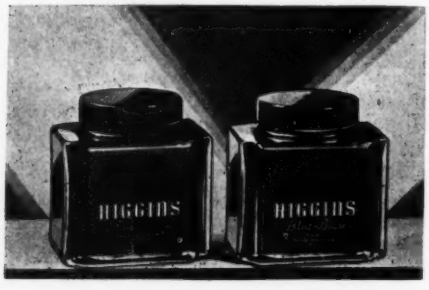
Electrical Shop—Motor and Testing Equipment

Annunciators
a) Automatic needle-drop
b) Gravity-drop
c) Manual needle-drop
Armatures — burnt-out, for repairing
Battery Charger — commercial
Circuit Breakers
a) Air, single-pole, overload, 25-amp., 550-volt
b) Air, single-pole, underload, 15-amp., 550-volt
Controllers
a) For multiple-speed motor
b) For 1-h.p., 110-volt series motors
Generators
a) Motor-generator set, 10-h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
b) Generator, 6-volt d.c., coupled to an a.c. motor for 6-volt circuit testing
c) Auto generators of different makes
Gravity Cells
Magnets — testing, 10,000-ohm
Meters
a) Ammeter, standard, 60-amp., a.c.
b) Ammeter, standard, 60 amp., d.c.
c) Ammeter, student, 60-amp., a.c.
d) Ammeter, student, 60-amp., d.c.
e) Voltmeter, standard, 0–10-volt, d.c.
f) Voltmeter, standard, 110–220-volt, d.c.-a.c.
g) Voltmeter, standard, 125-volt, a.c.
h) Voltmeter, standard, 125-volt, d.c.
j) Voltmeter, student, 110-volt, d.c.
k) Voltmeter, student, 110-volt, a.c.
l) Wattmeter, standard, 110–220-volt, 30–60-amp., d.c.-a.c.
m) Wattmeter, student, 110–220-volt, 30-amp., a.c.-d.c.
n) Watt-hour meter, 125-volt, 5 amp., a.c., single-phase, various makes
Motors
a) Auto starter, different makes
b) Burnt-out, fractional h.p., 110-volt, 60 cycle, for repairing
c) Compound, 1-h.p., 110-volt, d.c.
d) Multiple-speed, 1-h.p., 3-phase, 220-volt
e) Series, 1-h.p., 110-volt, d.c.
f) Shunt, 1-h.p., 110-volt, d.c.
g) Split-phase and repulsive, a.c., 110-volt, single-phase, assorted
h) Split-phase induction motors, fractional h.p., 110-volt, 60-cycle, different makes
j) 3-phase, 1 h.p., a.c., 220-volt, various makes
k) 3-phase, 2 h.p., 220-volt, a.c., various makes
l) Universal, fractional h.p., 110-volt, different makes
m) Universal, variable-speed, ½ h.p.
Platform Scale — 100-lb. capacity

(Continued from page 56A)

NEWLY DESIGNED HIGGINS INK BOTTLE

Chas. M. Higgins & Co., Inc., 271 Ninth St., Brooklyn, N. Y., are marketing their Higgins eternal black and Higgins blue-black writing ink in newly designed bottles and labels. In a five- and ten-cent packaging contest held recently in Rockefeller Center, New York, they were awarded honorable mention for their newly designed packaging.

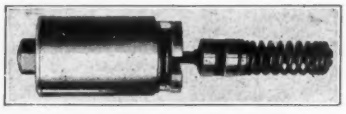


The judges were: Ruth Gerth, former president of the Artists' Guild and representative of the woman's viewpoint; Heyworth Campbell, former agency art director and authority on design; and William Longyear, director of package design at Pratt Institute.

NEW FORD VALVE-ASSEMBLY PULLER

Snap-on-Tools, Inc., of Kenosha, Wis., have announced a new Ford valve-assembly puller, a tool designed to pull the valve assembly after the locks have been removed. It is especially designed to remove valves that are difficult to remove because of carbon incrustations.

The tool is simple in construction, has a housing made of seamless tubing, and is cut at an angle on the end resting on the motor block, to insure a direct pull. The head of the puller is machined to fit under the valve head. Pressure is applied to the nut with a wrench and the entire assembly is pulled with little effort. The Ford valve-assembly puller requires but two operations to perform a quick, neat job.



Ford Valve-Assembly Puller

NEW DRIVER POWER TOOLS

The Walker-Turner Co., Inc., Plainfield, N. J., manufacturers of power tools, have issued their new 1937 catalog G-7, describing its new Series 500 of driver tools. The catalog lists gap bed lathes for wood and metalworking, jig saw, bench saws, band saws, drill presses, jointers, together with accessories for woodworking, metal turning, and spinning.

A copy of the catalog will be sent to any school-shop instructor upon request.

NEW STANLEY HARDWARE

The Stanley Works, New Britain, Conn., has issued its new No. B-46 folder, describing new hardware which every student in the school shop and every home craftsman can use in making new furniture or in remodeling old pieces. Among the products shown are braces for tables, hinges for chests and boxes, and a varied assortment of hardware supplies for cabinets, desks, and chests.

A copy of the folder may be obtained upon request.

CONSTANTINE VENEER CONTEST

Albert Constantine & Sons, New York City, are sponsoring a veneer contest, in order to create interest in veneering and to encourage craftsmen in a friendly contest in comparing their work with others. The contest will close on March 1 and the names of the winners will be announced on March 20.

The Constantine Company has offered a number of prizes for the winners of the contest. The first prize is $50, the second $25, the third $15, the fourth $10, and the fifth to twenty-fifth are prizes of $5 each.

NIAGARA HANDY REFERENCE BOOKLET

The Niagara Machine & Tool Works, Buffalo, N. Y., has announced a new handy reference booklet for sheet-metal workers, containing a variety of useful reference tables, condensed descriptions, and specifications of tools and machines used by the sheet-metal worker.

The booklet will be found useful in sheet-metal shops and plant maintenance departments. A copy of the booklet may be obtained by any shop instructor upon request.

ATKINS CLUB HOLDS ANNUAL DINNER

The Atkins Pioneer's Club of the E. C. Atkins Co., Indianapolis, Ind., held its thirty-first annual dinner and entertainment on February 6 at Indianapolis.

The Club presented Mr. Henry C. Atkins, Sr., president of the firm, with a 55-year service pin and also gave a 50-year pin to Mr. Henry C. Zschech, an employee.

Following the dinner, a business meeting was held, followed by a musical entertainment.

Puts the art of upholstery within easy reach of the amateur

UPHOLSTERED FURNITURE

BY C. W. SEAGER

Here is the most complete book on modern upholstery published. Every essential operation is included as are numerous "trade secrets" and helps heretofore unpublished. Includes a group of attractive upholstery pieces which utilize the operations. Profusely illustrated. $2.00

THE BRUCE PUBLISHING COMPANY

New York Milwaukee Chicago

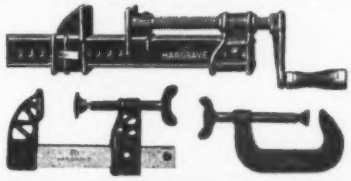
CLAMPS

Since 1879 HARGRAVE TOOLS have played an important part in American industrial development. Few tools indeed can boast a record as impressive.

HARGRAVE

Quality Clamps

These Hand Screws have proven very popular in the schools. They are strong, durable and satisfactory. The Jaws are selected hard maple. Spindle and bearings are steel.



More than fifty years ago HARGRAVE CLAMPS were designed and constructed to be the finest clamps on the market. The Line is complete and includes improved designs of every clamp used in woodworking and machine shop.

Catalog showing our complete line of Clamps, Chisels, Punches, Bench Anvils, Saw Vises and other tools will be mailed to you upon request.

THE CINCINNATI TOOL CO.

Waverly and Main Ave. Cincinnati, Ohio

(Continued from page 56A)

D. To Cut a Relished Tenon by Hand

Until one is thoroughly familiar with tenoning, it is well to proceed with the cutting as here suggested.

1. Lay out the tenon accurately.

2. Rip the cheeks and cut the shoulders to form a full-width tenon.

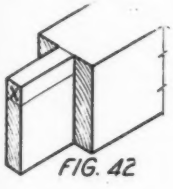


FIG. 42

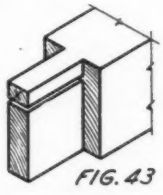


FIG. 43

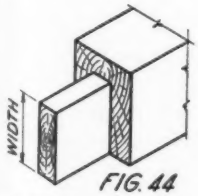


FIG. 44

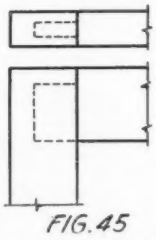


FIG. 45

3. Mark a relish line on one cheek of the tenon as shown in Figure 42

4. Ripsaw the relish to the shoulder line. Figure 43.

5. Complete the relish by sawing the shoulder.

One should learn to saw so accurately that only a ripsaw and a crosscut saw should ever be used for cutting a tenon.

The dimensions of a tenon are specified in the same order as lumber, that is, thickness, width, length. In the case of a relished tenon, the term "relished" should follow the dimensions. For example: 2 rails 1 by 2½ by 28 in., tenoned two ends, ⅜ by 2 by 1¾ in., relished.

NOTE: The width of the tenon specified is the finished width as shown in Figure 44.

The amount of relish depends upon several factors (see Factors That Govern the Width of Tenons, page 312, October, 1935, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION). For ordinary mill and cabinet work, the amount of relish may vary from ¼ in. to 1 in. Unless exact details are given, the amount of relish is left to the judgment of the workman. If one will simply cut the tenon to the dimensions specified, the amount of relish will take care of itself. Work is almost always *relished on one edge* only; it is very rare that work need be relished on two edges. Figure 45 shows an orthographic drawing of the relished-tenon joint.

E. The Relished-and-Haunched-Tenon Joint

Special conditions sometimes enter into cabinetwork which require that a tenon shall be relished more than usual. When this occurs, special provision must also be made to keep the broad faces of the two members in alignment; this is done by leaving a short "haunch" on the tenoned member and cutting a corresponding "recess" into the mortised member as shown in Figure 46.

This tenon is spoken of as a "relished-and-haunched" tenon. The length of the haunch is usually left to the judgment of the worker, but it is good practice to make the length of the haunch about equal to the thickness of the tenon.

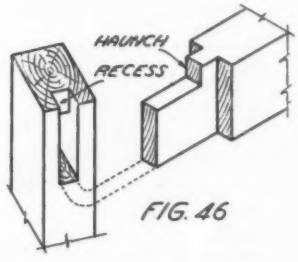


FIG. 46

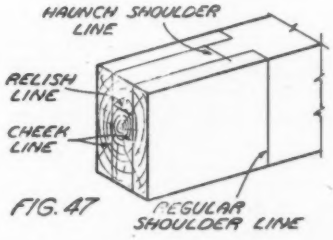


FIG. 47

When specifying this tenon, the dimensions should be given, followed by the note "relished and haunched." *Example:* 6 rails ⅞ by 2¼ by 18 in., tenoned 2 ends, 5/16 by 1¾ by 1¾ in., relished and haunched. Figure 47 shows a common-sense layout for a relished-and-haunched tenon.

(To be continued)

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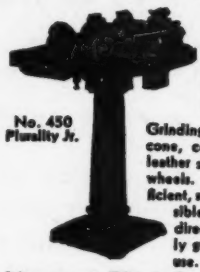

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